OPERATION AND MAINTENANCE MANUAL

ROCKAWAY BOROUGH WELLFIELD SUPERFUND SITE
KLOCKNER & KLOCKNER SOURCE AREA - OPERABLE UNIT 3
BOROUGH OF ROCKAWAY, NEW JERSEY
EPA IDENTIFICATION NO. NJD980654115

TRC Job No. 163292

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List of Acronyms

acfm	-	Actual cubic feet per minute
bgs	-	Below ground surface
CD	-	Consent Decree
cfm	-	Cubic feet per minute
COC	-	Contaminants of Concern
CRZ	-	Contamination Reduction Zone
cm^2	-	Square centimeter
CQAPP	-	Construction Quality Assurance Project Plan
yds^3		Cubic yards
DGA	-	Dense Graded Aggregate
DIR	-	Daily Inspection Report
ECDI	-	East Coast Drillers Incorporated
EM	-	Electromagnetic Induction
EPA	-	United States Environmental Protection Agency
ft^2	-	Square feet
ft^3	-	Cubic feet
GAC	-	Granular Activated Carbon
GPR	-	Ground Penetrating Radar
HASP	-	Health and Safety Plan
ID		Inside Diameter
IGWSCC	-	Impact to Groundwater Soil Cleanup Criteria
IW	-	Inches of Water
K&K	-	Klockner and Klockner
lbs	-	Pounds
mg/kg	-	Milligrams per kilogram
MPR	-	Monthly Progress Report
$\mu g/m^3$		Micrograms per cubic meter
NJDEP	-	New Jersey Department of Environmental Protection
No.	-	Number
O&M	-	Operation and Maintenance
OU	-	Operable Unit
PCE	-	Tetrachloroethene
PDI	-	Pre-Design Investigation
PM	-	Project Manager
PVC	-	Polyvinyl chloride

RA	-	Remedial Action
RCRA	-	Resource Conservation and Recovery Act
RAO	-	Remedial Action Objective
RAR		Remedial Action Report
RAWP/SMP		Remedial Action Workplan and Site Management Plan
RCA		Recycled Concrete Aggregate
RDR	-	Remedial Design Report
RDCSCC	-	Residential Direct Contact Soil Cleanup Criteria
RDWP	-	Remedial Design Work Plan
RG	-	Remediation Goal
RI/FS	-	Remedial Investigation/Feasibility Study
ROD	-	Record of Decision
ROI	-	Radius of Influence
scfm	-	Standard cubic feet per minute
SOW	-	Statement of Work
SCFM	-	Standard cubic feet per minute
SVE	-	Soil Vapor Extraction
System	-	SVE Vacuum/Blower System
TCE	-	Trichloroethylene
TCLP	-	Toxicity Characterization Leaching Procedure
TRC	-	TRC Environmental Corporation
TRSR		Technical Requirements for Site Remediation
QA	-	Quality Assurance
QAPP	-	Quality Assurance Project Plan
QC	-	Quality Control
VET	-	Vapor Extraction Trench
VLS	-	Vapor-Liquid Separator
VOC	-	Volatile Organic Compound
VP	-	Vapor Probe

OPERATION AND MAINTENANCE MANUAL
OPERABLE UNIT 3 - KLOCKNER AND KLOCKNER SOURCE AREA
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1.0 INTRODUCTION

This document presents the Operation and Maintenance Manual (O&MM) for the full scale Soil Vapor Extraction System (SVE) at the Klockner & Klockner (K&K) Source Area – Operable Unit 3 (OU3) in Rockaway Borough, Morris County, New Jersey (hereinafter designated as the "Site") (EPA Identification No. NJD980654115).

This O&M was prepared pursuant to the Record of Decision Operable Unit Three (ROD) issued by the US Environmental Protection Agency (EPA) – Region II in September 2007 and the Consent Decree (CD) and Statement of Work (SOW) originally filed on November 20, 2009

1.1 Site Description

The Rockaway Borough Wellfield Superfund Site is located in Rockaway Borough, Morris County, New Jersey (Figure 1). Rockaway Borough is situated in the center of Morris County, approximately 10 miles north of Morristown and 20 miles northwest of Newark in the north-central portion of the state. The K&K Source Area (identified as Block 5 Lots 1 & 6 and Block 7 Lot 7) is a portion of the larger Rockaway Borough Wellfield Superfund Site.

1.2 Site History

Investigations, conducted by the New Jersey Department of Environmental Protection (NJDEP) at the Rockaway Borough Wellfield Superfund Site since 1980, indicated the presence of VOC, primarily tetrachloroethene (PCE) and trichloroethylene (TCE) in the ground water.

Due to historic operations at the K&K source area, such as rocket manufacturing, EPA determined that areas of the Site had the potential to be contaminated with TCE and other constituents. The remedial investigation/feasibility study (RI/FS) at K&K Source Area was initiated in 1995. The RI/FS included collection and laboratory analysis of soil samples and soil gas surveys to identify the on-site source(s) and delineate the nature and extent of potential contamination in the soil at the property.

The contaminants of concern detected during the soil gas survey at elevated levels were TCE and PCE. Results for soil samples revealed TCE, PCE, and lead are the primary constituents at the K&K Source Area. TCE and PCE were generally present throughout the K&K Source Area, with TCE present at elevated concentrations in the soil (up to a maximum concentration of 90 mg/kg) adjacent to Building 12.

Based on the above findings at OU3, SVE was specified as the RA at the Building 12 property in the 2007 ROD to address the on-site source of ground water contamination:

Pursuant to the ROD, TRC conducted pre-design investigation (a SVE pilot test) at the Building 12

property to determine the design parameters (air permeability, Radius of Influence (ROI), etc.) for a full scale SVE system.

The design for a full scale SVE system was presented in a final Remedial Design Report (RDR), which was approved by the EPA in December 2011.

1.3 General Process Description

The SVE system at the Building 12 property includes eleven SVE wells (SVE-1 through SVE-11), one SVE trench well (VET-1), twenty-five vapor probes, and the SVE treatment unit (Figure 2).

Using the predicted optimal flow rate and vacuum of 78 acfm and 3.5 IW, respectively (determined from the pilot test for SVE-1), the total resulting system airflow rate will be at a maximum of 936 acfm, to run all wells simultaneously. However, TRC plans to operate only four of the 12 extraction points simultaneously and rotate the operational wells. The resulting flow rate is limited by the NJDEP permit to 312 scfm, which is approximately 319 acfm.

The vapor stream extracted from the SVE wells will be treated by two 1,000-lb. Granular Activated Carbon (GAC) vessels, connected in series.

2.0 PROCESS COMPONENTS

The SVE System is comprised of the following primary components (see Figure 2)

- Vapor extraction wells and piping;
- SVE treatment unit; and
- 2 x 1,000-lb GAC vapor treatment vessels. A description of the components is presented below.

2.1 Vapor Extraction Wells, Vapor Probes and Piping

- Vapor Extraction Wells- Eleven SVE Wells and one horizontal SVE trench well are installed at the Building 12 property within the designated treatment zone. The construction details are indicated on Figure 5 and the location of the SVE wells and trench at the Building 12 property are indicated on Figure 2 and are described below:

    - Eleven SVE wells (SVE-1 through SVE-11) are installed to a depth of approximately 13 feet below ground surface (bgs). Seven SVE wells (SVE-2 through SVE-8) are located inside Building 12. Four SVE wells (SVE-1, SVE-9 through SVE-11) are located outside Building 12 in the parking lot (Figure 2). The SVE wells are constructed of 4-inch schedule 40 PVC riser and screen. The screen interval starts at 3.5 feet bgs and extends to the bottom of the well. Refer to the construction logs for further details on the wells (Appendix A).

    - One SVE trench well (VET-1) was installed outside of Building 12 to a depth of approximately 6.5 feet bgs. The SVE trench well is constructed of 4-inch schedule 40 PVC riser and screen. The 20-foot long screen is placed horizontally in the trench and is connected to a vertical riser which is finished flush to grade. Refer to the construction logs for further details on the well (Appendix A).

- Vapor Probes- Twenty-five (25) vapor probes (VP-1 through VP-25) are installed at the Building 12 property. The construction details are indicated on Figure 5 and the locations of the vapor probes at the Building 12 property are provided on Figure 2 and are described below:

    - The vapor probes are installed to depths of approximately 10 to 11 feet bgs. The vapor probes are constructed of 1-inch schedule 40 PVC riser and screen. The screen interval starts at approximately 3.5 feet bgs and extends to the bottom of the well. Refer to the construction logs for further details on the vapor probe (Appendix A).
    - Eight vapor probes (VP-15 through VP-22) are located inside Building 12, and seventeen vapor probes (VP-1 through VP-14, and VP-23 through VP-25) are located outside Building 12 in the parking lot.

- Piping- The eleven SVE wells (SVE-1 through SVE-11) and the SVE well trench (VET-1) are connected to three header pipes (see Figure 2). Interior header pipes are installed above

grade and are hung from the Building 12 ceiling. Four wells are connected to each header pipe. The connection and construction details for the header pipes are provided in Figure 5 and are described below:

- Header 1 connects four SVE wells (SVE-2, SVE-3, SVE-5, and SVE-8) inside Building 12. Header 1 transitions from 4 inch to 6 inch Schedule 40 PVC pipe inside Building 12, to reduce the friction losses due to the length of the header pipe.

- Header 2 connects to SVE-1 located outside Building 12 and to SVE-4, SVE-6, and SVE-7 located inside Building 12.

- Header 3 connects to SVE-9, SVE-10, SVE-11, and VET-1, located outside Building 12.

- The header pipes are constructed of Schedule 40 PVC inside the building and along the Building 12 wall and Schedule 80 PVC inside the trench.

2.2 SVE System Treatment Unit

The SVE system has been procured from Specialty Systems Integrators, Inc. (SSI), of Plymouth, MN. The system will be housed in a 5' x 6' skid enclosure. The primary components of the system include the SVE blower, a vapor/liquid separator (VLS) and the piping manifold. The SVE blower will be a Spencer Vortex model VB075B regenerative blower. The VLS will operate to remove any liquid conveyed to the system before reaching the blower. A small transfer pump will be installed in the system to empty the VLS tank (Figure 3).

The Process and Instrumentation Diagram (P&ID) for the system is provided as Figure 4. The P&ID shows the position of all valves and instrumentation on the system. Flow, vacuum, temperature, and pressure gauges/meters will be installed prior to delivery to the Site.

The system manifold will have 3 legs; each connected to one of the manifold pipes. Solenoid/Motorized valves will be included on the manifold to allow for automatic switching between each leg.

A manual dilution valve will be installed with the system, to allow for the introduction of fresh air into the vapor stream. This valve will be opened or closed to decrease or increase the vacuum applied to the SVE well network, allowing the blower to operate on its curve, and reducing wear to the blower motor.

Vapor treatment will be accomplished through the use of two GAC vessels plumbed in series. The discharge stack will be connected to the second vessel. Vapor monitoring will determine the VOC removal efficiency, and will aid in determining the changeout schedule.

The proposed treatment system will be capable of applying a vacuum of 3.5 IW to each extraction well, with a resulting flow of approximately 78 acfm from each well. There will be 3 header pipes (two 4-inch and one 6-inch header pipes) connected to the manifold at the SVE Treatment System

(Blower). Because the system will be plumbed in three manifold legs of four extraction points each, each leg will operate between approximately 260 and a maximum of 312 acfm. Control valves will be installed at each well and on the manifold terminations at the trailer. The system will be equipped with solenoid/motorized valves on each manifold leg to automatically rotate from leg to leg on a set timing. Only one manifold leg will be operating except during long term operational air monitoring.

A vapor-liquid separator (VLS) is also contained within the treatment unit. This VLS will prevent water from the SVE well from passing through the blower. The VLS is equipped with a transfer pump and high level cut-off switch. The transfer pump will empty the VLS is sufficient water accumulates. The high level switch will stop the SVE blower operation in the event that the transfer pump is not operating. Any collected water will be transferred to an on-site water storage vessel for sampling and disposal.

The SVE system and GAC vessels will be located within a fenced area, restricting access to designated personnel (see Figure 2).

2.3 Electrical

The following are specifications for the electrical set-up of the SVE system:

Electrical Usage (Assuming an 84% Power Factor & 92% Motor Efficiency)											
Component	Qty	HP	Voltage	Amps			Each Watts	Total Watts	KW	% Usage	Total KW (Usage)
				L1	L2	L3					
SVE Blower	1	4.8KW	240	15	15	15	4,813	4,813	4.81	100%	4.81
Transfer pump	1	0.75	240	2.8	2.8	2.8	898	898	0.9	25%	0.22
XP Heater	1		240	4.7	4.7		1,508	1,508	1.51	50%	0.75
XP Exhaust Fan	1		115	7			1,076	1,076	1.08	50%	0.54
Non-XP Exhaust Fan	1		115			7	1,076	1,076	1.08	50%	0.54
Control Panel Control Circuit	1		115			5	575	575	0.58	100%	0.58
			Total Amps:	30	23	30			9.9		7.44

Voltage: 240 VAC
Phase: 3 Phase
Power Service Recommendation: 200 Amps

Power to the system will be provided by a new electrical service, located within the system area. The control panel for the unit is located on the side of the skid mounted system. The control panel houses the electrical connections from the grid, and contains the switches and timers for the individual components.

3.0 OPERATIONS PROCEDURES

This section presents general procedures to start, operate, monitor, and shut down the SVE system.

At all times, ensure all activities are compliant with the requirements of the site-specific health and safety plan (HASP). A copy of the HASP must be available on site at all times.

All site visits should be coordinated and scheduled with the Facility Production Manager. All on-site activities, observations and weather conditions should be recorded in a site-specific field book.

3.1 SVE Treatment System Testing and Start-up

At all times during the testing and operation of the system, conditions established in the approved NJDEP air permit must be followed. A copy of the NJDEP air permit must be available on site at all times.

The NJDEP air permit can be found in Appendix B.

3.1.1 System Shakedown

The following sequence is performed by the operator to complete the 'Initial Start' step for each of the three manifold legs:

1. On the control panel turn main control panel to the "ON" position.
2. On the control panel reset any alarm conditions.
3. Calibrate Magnehelic gauges prior to start.
4. Establish air monitoring background locations at the Site; document VOC readings with a Photo Ionization Detector (PID) at these locations and test the probes
5. Run SVE blower with the dilution valve fully open, and gradually close to achieve desired flow rate. If water is drawn into the manifold, gradually open the dilution valve to determine the maximum flow rate without extracting water. (Note: Do not exceed the maximum flow rate set forth in the Air Pollution Control Pre-Construction and Certificate to Operate Permit, which is approximately 318 acfm).
6. Verify and record operating temperatures and vapor flows.
7. Record VOC readings at influent, mid-GAC, and effluent sample points on the induced vacuum/perimeter air monitoring log sheet (Appendix C).
8. After approximately 30 minutes, open the next manifold solenoid/motorized valve and close the first.
9. Determine and record the minimum dilution valve opening, and adjust the manifold control valve to achieve equal flow on all legs.

3.1.2 SVE System Initial Start-up

The following are the steps that will be implemented during the first week of operation of the SVE system, after shake down has determined the blower and GAC vessels are operating correctly.

- Step-by-step instructions are included in Table 1 of Appendix C.

- Perform one round of perimeter air quality monitoring using the PID (at background and test area locations) at the beginning and end of each step. Record data on Table 2 in Appendix C.
- As discussed above, three header pipes will be connected to the manifold at the SVE System (Blower). The SVE System will be equipped with solenoid/motorized valves which will be used to rotate between the three header pipes. The header pipes that are not in operation will be closed shut by the solenoid/motorized valve. At a given time, only one header pipe will be in operation. The SVE system will operate continuously (24 hours daily) and will be programmed to switch from one header pipe to another after every 8 hours of operation.
- The target for the full scale SVE System is to achieve a flow rate of 78 acfm by applying a vacuum of 3.5 IW at each well. The SVE system will be tuned to attain the required flow rate at each well. However, the maximum flow rate through each manifold cannot exceed approximately 318 acfm or 312 scfm, which is the NJDEP permitted maximum.
- During the SVE system operations, applied vacuum will be recorded every 30 minutes at the SVE wells, which are in operation and at the vapor probes, located in the vicinity of the SVE wells.
- Take readings by temporarily connecting the Magnehelic Gauge to the vapor probe- SVE Well adaptor, creating a tight seal and covering the rear ports on the Magnehelic Gauge. During this test, all readings should be in inches of water (IW). Please note that positive readings (pressure) may be observed and must be clearly labeled with a plus sign ("+"). Note: The Magnehelic gauge selected must be in the required incremental range for the vapor probe (i.e., 0-0.25, 0-1, 0-10, 0-20, or 0-100 IW).
- Record the applied vacuum (and air flow rate) at the extraction well every 30 minutes. Use Table 2 in Appendix C to record all readings.
- Field staff should ensure all readings are coordinated.
- Seal probes between readings.
- Adjust valves at each operating SVE well to achieve equal vacuum. The valve at the most distant well should be left open.
- Inspect the system fittings, connections and wellheads for leaks using smoke. Implement the necessary adjustments and repairs. The smoke for the tests should be generated by a sparkles device.
- Upon attaining the required flow rate of 78 acfm or 3.5 IW at each of the four SVE wells, run the system for 4 hours before switching to the next header pipe. Do not allow the system to run overnight without completing this procedure on all manifold legs.
- Repeat the same procedure for all three header pipes. Use different data sheets to document monitoring measurements for each SVE well.
- Take PID readings every half hour to one hour and in accordance with the permit requirements for influent and effluent samples. System readings should be recorded at the beginning of the test and checked every half hour. Any changes should be noted and recorded. Use Table 3 in Appendix C to record all readings.
- Collect one set of influent and effluent air samples from each manifold leg during the first week of operation. The air samples will be used to assess compliance with the NJDEP air

permit, and will be used to assess contaminant removal rates. The influent and the effluent samples should be collected in a laboratory provided stainless steel Summa canister for TO-15 analysis from the respective sample ports. The Summa canisters should be equipped with a pre-set regulator, to draw a sample over 30 minutes. The air samples should be sent to a New Jersey certified laboratory for analysis.

3.2 SVE System Emergency Shutdown and Response Guidelines

Emergency shutdown may be required under the following circumstances: power failure, recirculation system piping leaks, fitting failure causing leaks, a fire during normal operation, any potential safety hazards, the VLS tank is overfilled with liquid, or permit compliance not being attained (e.g., the flow rate exceeding 318 acfm/312 scfm at a leg; GAC breakthrough; or temperature exceedances).

The emergency shutdown sequence is as follows:

1. Push the emergency stop button on the control panel.
2. Verify Site security (fence is standing).
3. Record any alarm on the control panel.
4. Turn off the power.
5. Verify the issue that is causing the shutdown and call the Project Manager (PM).
6. Troubleshoot the problem under the PM's direction.
7. Do not turn the system back on without permission from the PM or their designee.

3.3 Planned and Unplanned Shutdowns

Several switches and sensors can initiate an automatic system shutdown if a process parameter falls outside of a preset range. These interlocks and the control logic are shown on the P&ID in Figure 4. In all cases, an alarm code will illuminate indicating each fault that was actuated, and the panel view will show a "firstout" indication of which alarm condition occurred first.

Information related to the time, cause, or corrective action(s), and any other observations related to the shutdown, should be recorded in the field book. The shutdown time will be displayed on the control panel.

4.0 OPERATION AND MONITORING

All site visits should be coordinated and scheduled with the Facility Production Manager.

During the system operation, data is collected from the vapor probes, SVE wells, the SVE system, as well as perimeter air monitoring and the data will be recorded on the Induced Vacuum/Perimeter Air Monitoring Log Sheet (Appendix C). Air samples are collected from the system influent and effluent vapor streams for laboratory analysis. Vacuum, pressure, temperature and differential pressure gauges are used to collect readings from the system and vapor probes. A hand-held PID and a multi gas analyzer are used to check ambient and process air. The multi-gas meter contains carbon monoxide, hydrogen sulfide, oxygen and lower explosive limit (LEL) sensors.

PID readings will be collected at each well head, from the installed sample port. Since the vacuum applied by the hand-held PID will not be strong enough to draw the sample against the vacuum of the SVE blowers a handheld battery operated vacuum pump will be used. This vacuum pump will operate in the range of 30 to 40 IW and will be used to collect PID readings from individual wells. The vacuum pump will be connected to the respective sample ports with Teflon tubing. The outlet from the vacuum pump will be connected to PID with Teflon tubing to collect the respective sample.

Vapor will be treated with two 1000-lb. GAC units installed in a lead-lag configuration. The contamination reduction rate from the influent stream by the two 1000-lb GAC units is anticipated to be 99%. The mid-treatment PID readings will be used to assess the adsorptive capacity of the primary GAC vessel. Change outs will occur after breakthrough (10% of influent concentration) of the first unit but before breakthrough of the second unit. When the primary vessel is spent, the GAC will be replaced, and the secondary vessel plumbed to the primary treatment location. GAC will be either re-generated or disposed of off-site by the vendor. Periodic samples may be collected from the GAC vessels to ensure proper classification and disposal.

TRC will collect three influent and three effluent samples during the first week of operation (one from each header pipe). The samples will be collected using six (6) liter Summa canisters with a one-half hour regulator. The sample canisters will be connected to the sampling ports and will be collected during the long term test operations. The samples are analyzed for the full set of target compound list VOCs, using the EPA TO-15 method. The samples are sent to Accutest Laboratories, Inc. of Dayton, NJ, a NJDEP-certified laboratory.

Equipment specific operation and maintenance (O&M), such as blower lubrication or flow meter replacement will be conducted per the manufacturer's requirements, contained in Appendix E.

Routine operations generally consist of monitoring and adjusting the process conditions to assure continued operation in the desired configuration, replacing expendable materials (such as filter elements, checking liquid levels in tanks, checking the condition of the GAC), and checking the system for abnormal conditions (such as leaks, abnormal noise, temperature, or vibration).

Routine operating and process monitoring data should be recorded on a site-specific SVE Process Data Sheet. All on-site activities, observations and weather conditions will be recorded in a site-specific field book. A detailed summary of Site monitoring procedures is provided below.

4.1 Periodic SVE System Measurements (Every Visit)

During each monthly Site operation and maintenance visit perform the following activities. They should be recorded on the System Log Sheet. Site visits should be coordinated and scheduled with the Facility Production Manager.

- Notify the Facility Production Manager of your arrival and inform him of your activities.
- Check to see that the SVE system is operating and that no alarm conditions are present.
  - If the system is not operating and there are alarm conditions present, refer to the SSI's system manual to troubleshoot. If the problem cannot be found or alleviated then call the PM.
- Check the volume of liquid in VLS tank to ensure it is not near capacity (e.g., >50% full).
  - If the VLS tank is nearing capacity, pump the fluids into the on-site holding tank.
- Record the run time of the SVE blower and the VLS transfer pump on the system log sheet (Appendix C).
- Take note of any visible damage to the system anywhere (e.g., SVE system, fencing, wellheads, etc.) and immediately notify the PM if damage is found.
- Perform a Site walk to verify that all measurement locations are not blocked by equipment or materials.
- Calibrate the rented RAE Systems Multi-RAE
  - Refer to Pine Environmental documentation for calibration instructions
  - Ensure that all calibrations are within the accepted tolerances
- Collect PID Readings from the effluent, mid-treatment and influent sample ports.
- Record system measurements on the System Log Sheet (Appendix C).

The following equipment and material should be brought to the site during each site visit:

- Multi-RAE
- Tool box
- Magnahelic gauges (scale 0-0.5 IW, 0-1, 0-10, and 0-100)
- Tubing (1/8")
- Blank log sheets
- Field book
- HASP

4.1.1 Vacuum & PID Measurements (Every Visit)

Once the above items have been performed, complete the following tasks and record on the Induced Vacuum/Perimeter Air Monitoring Log Sheet:

- Following the system measurements, proceed with gathering the induced vacuum and PID measurements from the SVE wells and Vapor Probes associated with the operating header.
  - The associated locations are grouped by header on the log sheet.
  - Measurements should be collected using a magnehelic gauge with the proper range.
  - To find the proper range, start with a higher range gauges (e.g., 0-10 inches of water).

If the reading is below the next gauge's maximum reading then move to that gauge to gather a more accurate reading.

- Hold the gauge level in both directions in order to gather an accurate measurement.

- Upon completing all of the measurements at the SVE Wells and Vapor Probes go to the SVE system trailer and switch the operation of the system to next header.
- Allow the SVE system to stabilize and start the next round of readings at the system and the SVE wells and VPs after 30 minutes.

4.1.2 Perimeter Air Monitoring (Every Visit)

Air monitoring will be conducted during each Site visit while the SVE system is operating. VOCs will be monitored with a PID.

All readings will be recorded in the field logbook. Action limits are defined in the HASP.

4.1.3 Air Sampling (Periodic)

Air samples will be collected during startup, and then on a quarterly basis thereafter. Routine air sampling procedures are outlined below.

Following the completion of all the SVE well and VP location measurements proceed with the air sampling by performing the following tasks:

- Open all three headers to the SVE system and allow the system to run for thirty minutes to stabilize.
- During the stabilization period prepare the air sampling canisters by doing the following:
  - Make sure that the Summa canisters are the larger 6 liter canisters.
  - Make sure that the flow controllers are 30 minute flow controllers.
  - Record the flow controller number and the Summa can number in the field book for the influent and effluent air samples.
  - Attach the flow controllers to the Summa canister and do not over tighten (1/2 turn past hand tight) the threaded connections since that will damage the threads.
  - Cut two new lengths of silicone tubing to attach to the influent and effluent sampling ports to use for sampling.
- Open the sampling valves without the Summa canisters connected to the tubing to allow the air flow to displace any air present in the tubing.
- Connect the sample canisters and open the flow control valves and record the initial pressure, which is in inches of mercury (Hg).
- Allow the sample canisters to collect the samples and end the sampling when the canister pressure falls below 5 inches of Hg. The effluent canisters will fill quicker than ½ hour, because the flow is under pressure.

4.1.4 SVE Liquid Sampling (Periodic)

Twice during the course of the SVE operation, liquid samples will be collected if liquids are generated. The samples will be collected directly from the storage tank using a bailer.

4.2 Typical Routine Preventative Maintenance

- Inspect and check the power source.
- Inspect all system equipment and batteries for safe working conditions.
- Inspect all accessible system fitting, connections and components for leaks and repair and adjust as necessary.
- Start up and shut down all blowers, compressor and pumps. Check all valves and inspect all gauges to ensure proper operation.
- Review the system operation manual to ensure that no components are used or operating improperly.
- Inspect GAC and plumbing and conduct preventative maintenance.
- Inspect blower in accordance with the manufacturer's manual.
- Inspect VLS pump and conduct preventative maintenance.

5.0 AIR MONITORING REQUIREMENTS

In accordance with NJDEP Permit Activity Number PCP120001 for the Klockner & Klockner Source Area (OU3), Facility ID Number 26792, the following provisions must be followed at all times:

- At all times while operating, GAC breakthrough shall be defined as: Total VOCs > 50 ppmv as Isobutylene measured between the two (2) GAC units. Total VOCs shall be monitored by periodic emission monitoring, based on 3 minute intervals using a PID/FID or equal monitoring device. The monitoring period is daily during the first week of the SVE system installation, then weekly within first month of operation and monthly thereafter. All monitoring results shall include date of meter reading, GAC column designation, effluent gas throughput (scfm), VOC meter reading (ppmv as isobutylene, and corresponding total VOC mass emission rate (lb/hour) prior to, or at breakthrough.
- Total VOCs shall be ≤ 20 ppmv as isobutylene measured in the effluent gas (downstream from CD2). Monitoring requirements are the same as provision 1.
- Blower Extraction Rate shall be ≤ 312 acfm. It should be recorded once initially (the specification and operating performance curves of the soil vapor extraction blower including its maximum throughput shall be kept on-site or at the permittee's main office).
- There shall be no visible emissions, exclusive of condensed water vapor, except for a period of less than three minutes in any consecutive 30 minute period. Opacity will be monitored by a visual determination upon occurrence of event, based on an instantaneous determination.
- Permittee shall post the name of the contact person with address and phone number on a permanent, legible sign in a conspicuous location of the SVE system prior to beginning work (make sure sign is up).
- Permittee shall notify the NJDEP in writing at least 7 days prior to the start-up of the SVE system for the first time.
- Permittee shall notify the NJDEP in writing within 30 days of full completion of the operation of the SVE system and shutting it down permanently.
- The system equipment shall not cause any air contaminant, including an air contaminant detectable by the sense of smell, to be present in outdoor atmosphere in such quantity and duration which is injurious to human health or welfare, animal or plant life or property, or would unreasonably interfere with the enjoyment of life or property. Permittee shall record date and time when operation of permitted equipment caused or has potential to cause off-property effects.
- The potential to emit of total VOCs, speciated HAP and TXS identified by the permittee and any regulated criteria air pollutant shall be below their respective reporting threshold levels.
- Monitoring shall be by grab sampling semi-annually: once every six months; six month cycle shall begin on January 1 and July 1 of each year. Take a TO-15 grab air sample using Summa canisters collected at the stack downstream from CD2 upon startup of the SVE treatment

system, and semi-annually during the first year after startup. The permittee shall calculate maximum hourly emission rate and corresponding yearly emission of any air contaminant identified in the permittee's application using semi-annually analytical laboratory air sampling and testing results. Keep records of certified lab analysis results.

6.0 CONTACTS

Name	Title	Organizational Affiliation	Responsibilities	Phone Number
Nidal Rabah	Project Coordinator	TRC	Manages project – coordinates field team and subcontractors.	973-564-6006 x240
Howard Nichols	Deputy Project Coordinator/Project Engineer	TRC	Manages project – coordinates field team and subcontractors.	973-564-6006 x303 973-610-8529 (cell)
Bhuvnesh J. Parekh	Field Team/QA Manager	TRC	Supervises all field activities	973-564-6006 x336
Samir Bouzrara	Owner of Specialty Systems Integrators	Specialty Systems Integrators (SSI)	SVE System Supplier	763-450-2600
Matt Cordova	Project Manager	Accutest Laboratories, Inc	Laboratory	732-329-0200
Pine Environmental	General Line	Pine Environmental	Equipment Rental	609-371-9663

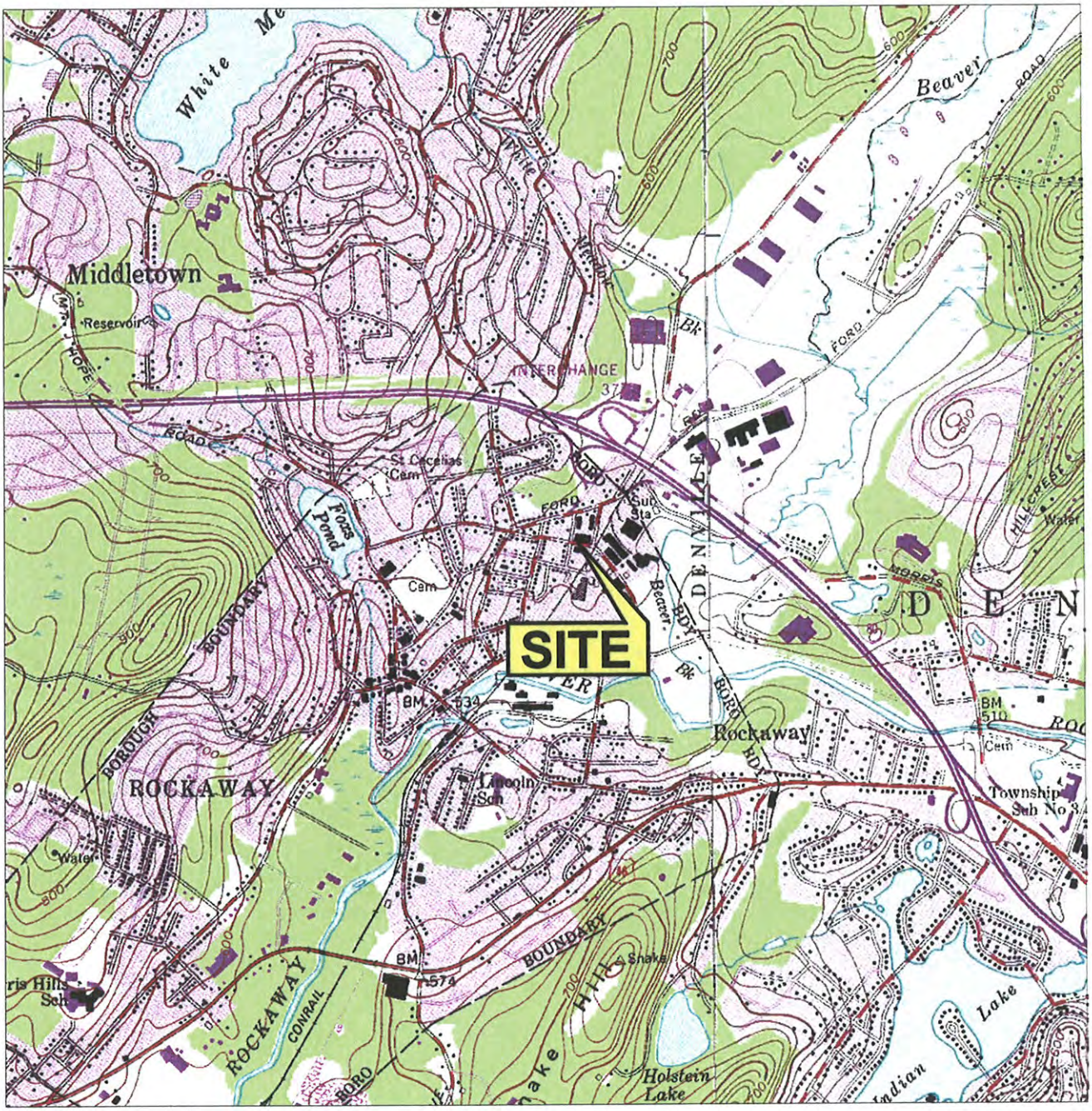
7.0 HEALTH AND SAFETY PLAN

A site-specific Health and Safety Plan (HASP) has been prepared for this project (Appendix A). This HASP covers minimum safe work practices about excavation, electrical, fire, safety, security, health, environmental and traffic requirements. This HASP will be amended as and when required to accommodate any additional un-safe conditions that are observed at the Site.

FIGURES

FIGURE 1

SITE LOCATION MAP



SOURCE: DOVER AND BOONTON, N.J. QUADRANGLES, 1954, PHOTOREVISED 1981
7.5 MINUTE SERIES (USGS TOPOGRAPHIC MAP)

TRC ENVIRONMENTAL CORP.
57 East Willow Street
Millburn, New Jersey 07041

N

0 2000 FT.

APPROXIMATE SCALE

QUADRANGLE LOCATION

SITE LOCATION MAP

KLOCKNER PROPERTY – ROCKAWAY, NJ

JOB NO.: 163292

BJ/LB	DATE: JANUARY 2010	FIGURE: 1

M:\CAD FILES\VISION PROJECTS\163292\163292_SLM.DWG 02/12/2010 08:08:22PM TAB: LAYOUT

FIGURE 2

BUILDING 12 SVE WELL LAYOUT

ELM STREET

HIBERNIA AVENUE

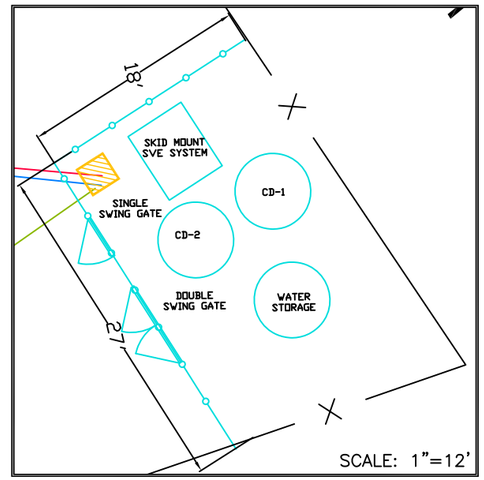
N.J.S.P.C.S.(NAD'83)

VP-15
SVE 2
VP 16
SVE 4
VP 17
SVE 3
VP 20
SVE 7
SVE 6
SVE 5
VP 18
VP 19
VP 21
SVE 8
VP 22
SVE 9
SHED
VP 23
VP 24
SVE 10
VP 13
VP 14
VET-1
VP 9
VP 8
VP 10
VP 11
VP 12
VP 25
QUONSET HUT
CURB
SVE 11
VP 7
VP 1
VP 4
VP 5
VP 6
SVE 1
VP 3
VP 2

4" SCH 40 PVC
4" SCH 40 PVC
4" SCH 40 PVC
6" SCH 40 PVC
4" SCH 40 PVC
6" SCH 80 PVC
4" SCH 80 PVC
4" SCH 80 PVC

SEE INSET

INSET
TO BE INSTALLED



SCALE: 1"=12'

LEGEND

- SVE WELL LOCATION
- VAPOR PROBE LOCATION
- EXTRACTION TRENCH
- VET RISER
- HEADER PIPE #1
- HEADER PIPE #2
- HEADER PIPE #3
- HEADER PIPE CONVERGING AREA

0 20 FT.
APPROXIMATE SCALE

TRC ENVIRONMENTAL CORP.
57 East Willow Street
Millburn, New Jersey 07041

AS-BUILT SVE WELL LAYOUT
BUILDING 12

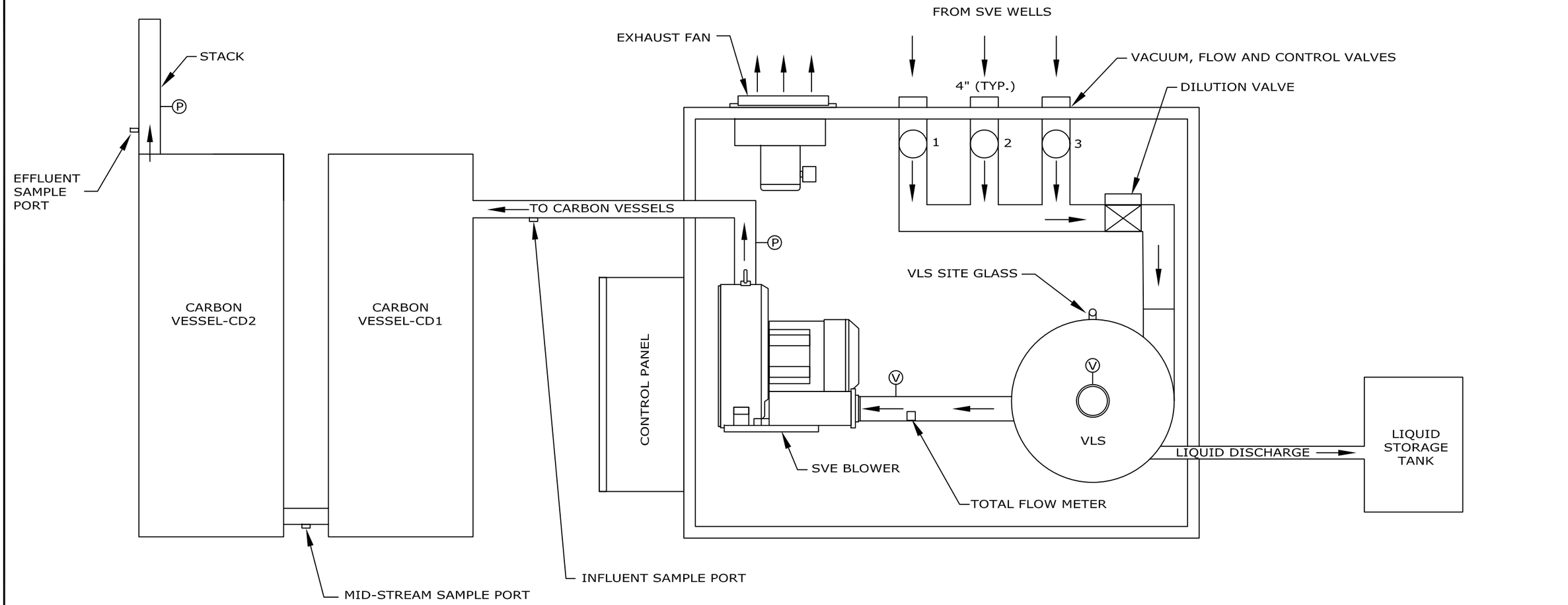
KLOCKNER PROPERTY – ROCKAWAY, NJ

PREPARED BY: BJP/TM	DATE: MARCH 2013
JOB NO.: 163292	FIGURE: 2

M:\CAD FILES\VISION PROJECTS\163292\AS-BUILT\AS-BUILT SVE LAYOUT.DWG 04/29/2013 05:27:59PM TAB: SITE PLAN -- 11x17 (2)

FIGURE 3

SVE SYSTEM LAYOUT



LEGEND

PRESSURE GAUGE —Ⓟ

VACUUM GAUGE —Ⓥ

NOT TO SCALE

TRC ENVIRONMENTAL CORP.
57 East Willow Street
Millburn, New Jersey 07041

SVE SYSTEM LAYOUT

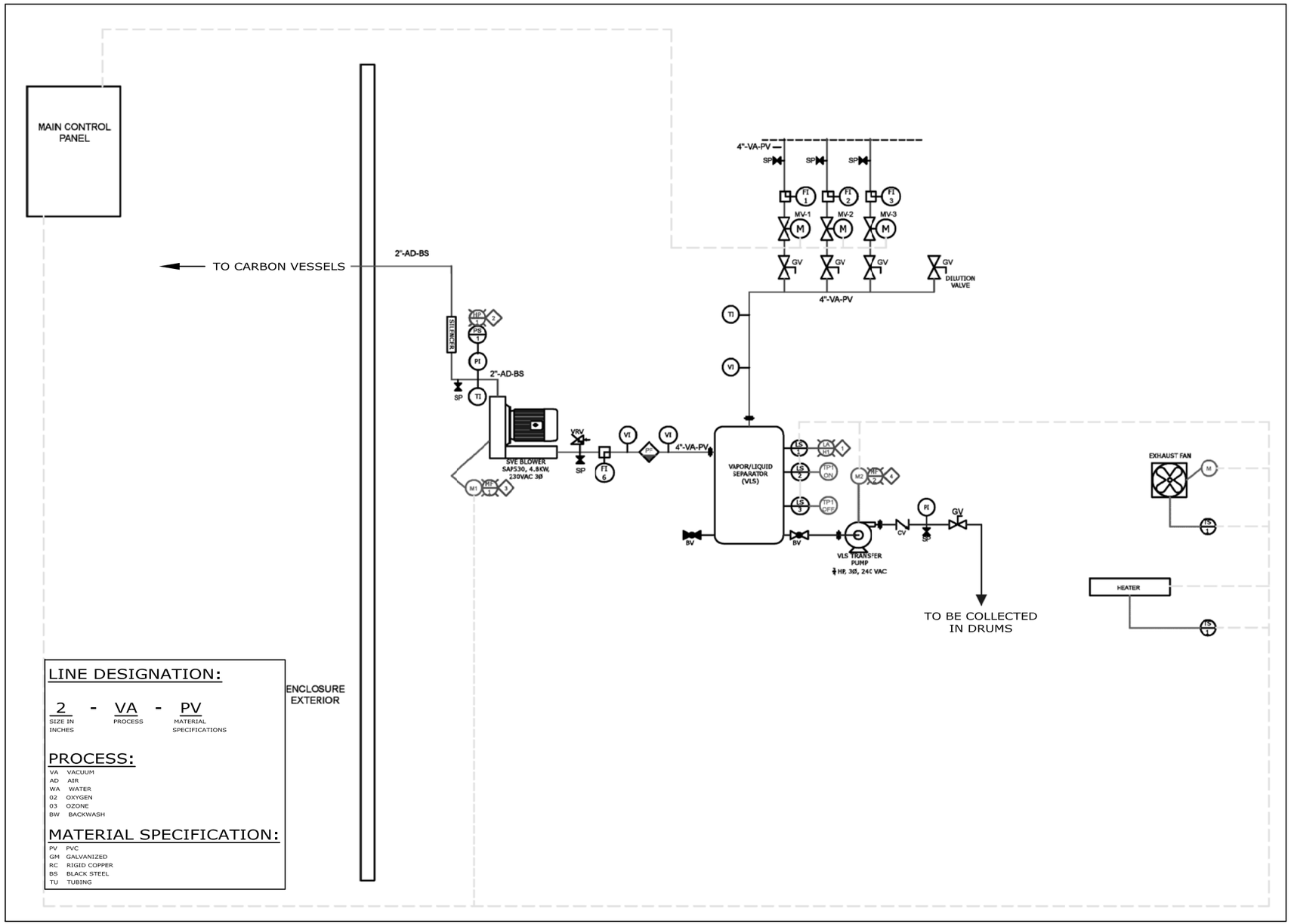
KLOCKNER PROPERTY – ROCKAWAY, NJ

PREPARED BY: AG/TM	DATE: APRIL 2013
JOB NO.: 163292	FIGURE: 3

M:\CAD FILES\VISION PROJECTS\163292\O&M MANUAL\AS-BUILT SVE LAYOUT-2.DWG 04/29/2013 05:18:02PM TAB: SVE SYS

FIGURE 4

PROCESS AND INSTRUMENTATION DIAGRAM (P&ID)



LEGEND

- SOLENOID VALVE
- BUTTERFLY VALVE
- GLOBE VALVE VALVE
- BALL VALVE
- GATE VLAVE
- CHECK VLAVE
- UNION
- SAMPLE VLAVE
- VALVE NORMALLY OPEN
- VALVE NORMALLY CLOSED
- VACUUM RELIEF VALVE
- PRESSURE RELIEF VALVE
- PARTICULATE FILTER
- PRESSURE INDICATOR
- VACUUM INDICATOR
- TEMPERATURE INDICATOR
- SIGHT TUBE
- LEVEL SWITCH No (x)
- TEMPERATURE SWITCH No (x)
- FLOW METER No (x)
- ANALOG TEMPERATURE TRANSMITTER No (x)
- ANALOG FLOW TRANSMITTER No (x)
- ANALOG VACUUM TRANSMITTER No (x)
- RELATIVE HUMIDITY TRANSMITTER No (x)
- HIGH LEVEL ALARM No (x)
- LOW FLOW ALARM No (x)
- LOW VACUUM ALARM No (x)
- HIGH VACUUM ALARM No (x)
- RELATIVE HUMIDITY ALARM No (x)
- MOTOR OVERLOAD No (x)
- FATAL ALARM No (x)
- CONTROL PANEL READOUT
- MOTOR

NOT TO SCALE

TRC ENVIRONMENTAL CORP.
57 East Willow Street
Millburn, New Jersey 07041

PROCESS & INSTRUMENTATION DIAGRAM

KLOCKNER PROPERTY – ROCKAWAY, NJ

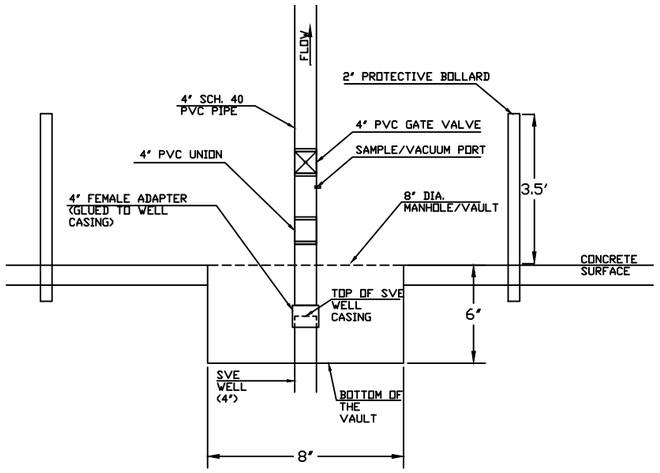
PREPARED BY: AG/TM	DATE: APRIL 2013
JOB NO.: 163292	FIGURE: 4

M:\CAD FILES\VISION PROJECTS\163292\O&M MANUAL\AS-BUILT SVE LAYOUT-2.DWG 04/29/2013 05:36:10PM TAB: PID

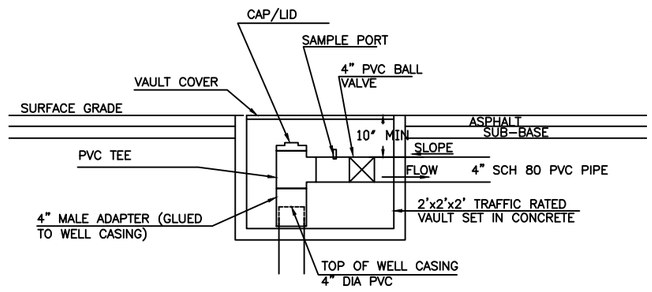
FIGURE 5

AS-BUILT CONSTUCTION DETAILS

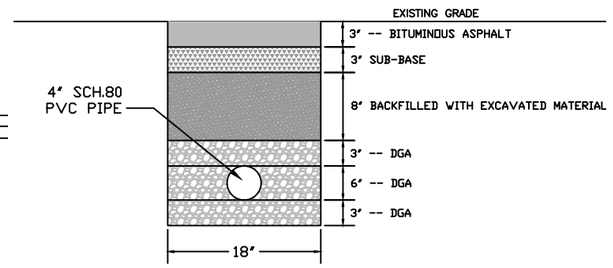
DETAIL 1
INTERIOR SVE WELL COMPLETION
NOT TO SCALE



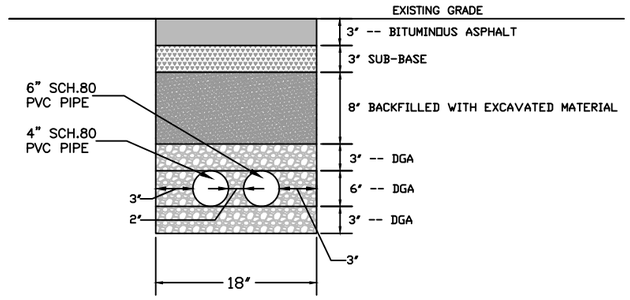
DETAIL 2
EXTERIOR SVE WELL COMPLETION
NOT TO SCALE



DETAIL 3A
CROSS SECTION A–A' OF TRENCH RESTORATION
NOT TO SCALE

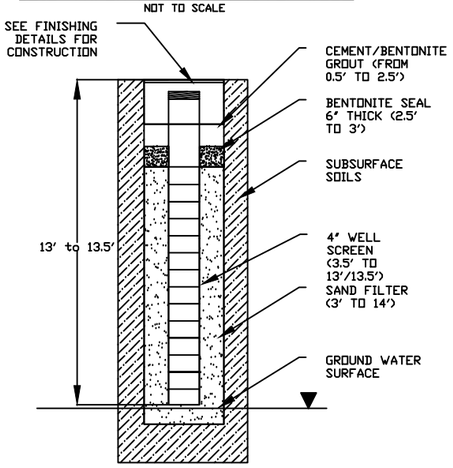


DETAIL 3B
CROSS SECTION B–B' OF TRENCH RESTORATION
NOT TO SCALE

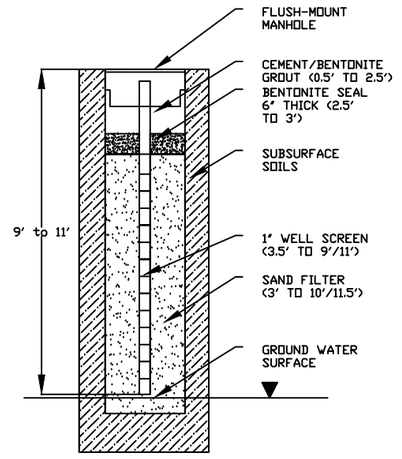


DETAIL 4
SVE WELL AND VP CONSTRUCTION DETAILS

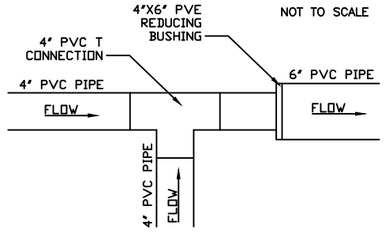
SOIL VAPOR EXTRATION (SVE) WELL
NOT TO SCALE



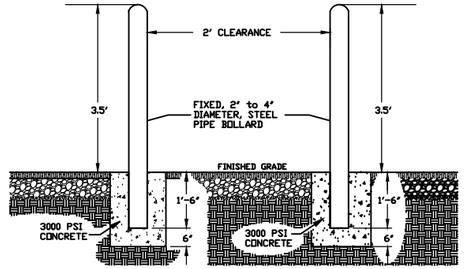
VAPOR PROBE
NOT TO SCALE



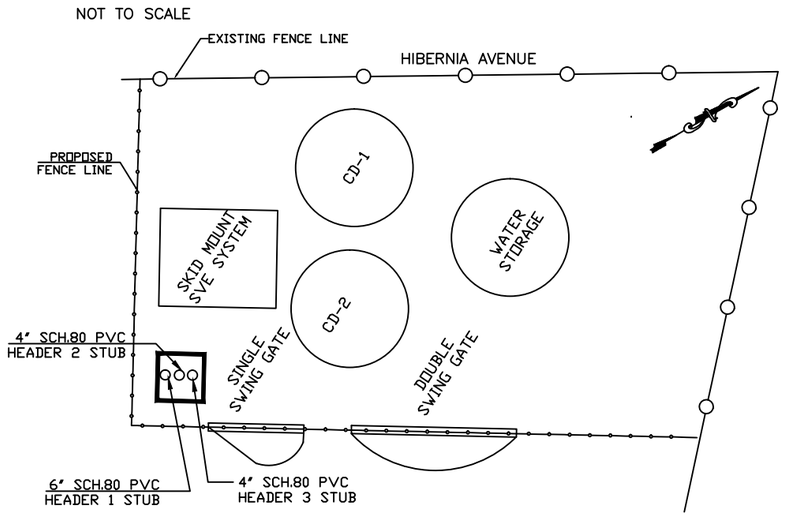
DETAIL 5
PIPE ENLARGEMENT DETAIL
NOT TO SCALE



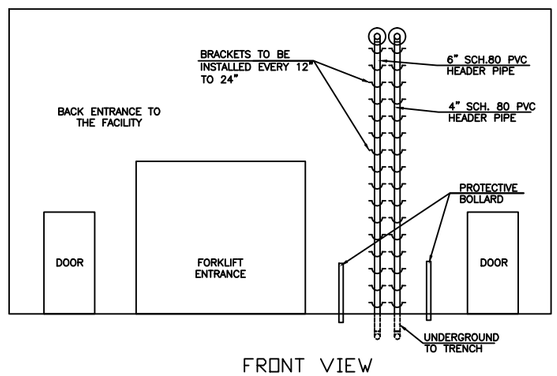
DETAIL 6
CONSTRUCTION DETAIL FOR BOLLARD
NOT TO SCALE



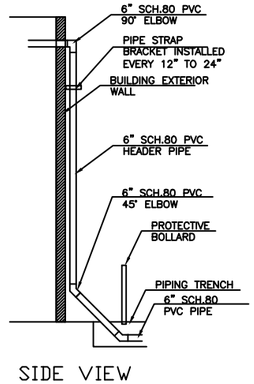
DETAIL 7
PIPE CONVERGANCE DETAIL
NOT TO SCALE



DETAIL 8
SVE HEADER PIPE WALL PENETRATIONS AND TRENCH ENTRANCE
NOT TO SCALE



FRONT VIEW



SIDE VIEW

TRC ENVIRONMENTAL CORP.
57 East Willow Street
Millburn, New Jersey 07041

AS–BUILT CONSTRUCTION DETAILS

KLOCKNER PROPERTY – ROCKAWAY, NJ	
PREPARED BY: BJ/SJ	DATE: MARCH 2013
JOB NO.: 163292	FIGURE: 5

TABLES

TABLE 1

SUBCONTRACTOR & VENDOR CONTACTS

Table 1
Subcontractor & Vendor Contacts
Klockner & Klockner
163292

Project Engineer/Deputy PM	TRC Environmental Corporation 57 East Willow Street, Millburn, NJ	Howard Nichols, P.E. 932-564-6006 x303
Field Engineer	TRC Environmental Corporation 57 East Willow Street, Millburn, NJ	Philip Bosco 932-564-6006 x333
Facility Production Manager	Service Metal Fabricators, 10 Stickle Avenue, Rockaway, NJ	Glen Blue 973-625-8882
Laboratory	Accutest Laboratories, Inc. 2235 Route 130, Dayton, NJ	Matt Cordova 732-329-0200
Equipment Rental	Pine Environmental Windsor Industrial Park, 92 North Main Street, Bldg 20, Windsor, NJ 08561	609-371-9663
System Designer	Specialty Systems Integrators 14150 23rd Ave. North Plymouth, MN 55447	Samir Bouzrara 763-450-2600

APPENDICES

APPENDIX A

HEALTH AND SAFETY PLAN

HEALTH AND SAFETY PLAN
BUILDING 12 SOIL VAPOR EXTRACTION SYSTEM AND BUILDING 13 VOC EXCAVATION

ROCKAWAY BOROUGH WELL FIELD SUPERFUND SITE
KLOCKNER AND KLOCKNER OPERABLE UNIT 3
BOROUGH OF ROCKAWAY, NEW JERSEY
EPA IDENTIFICATION NO. NJD980654115

TRC Job No. 163292

Prepared by:

TRC Environmental Corporation
57 East Willow Street
Millburn, New Jersey 07041

August 2012

SITE-SPECIFIC
HEALTH AND SAFETY PLAN
EPA IDENTIFICATION NO. NJD980654115
ROCKAWAY BOROUGH WELL FIELD SUPERFUND SITE
KLOCKNER AND KLOCKNER OPERABLE UNIT 3
BOROUGH OF ROCKAWAY, NEW JERSEY

Prepared by: _____ Date: _____
BJ Parekh, Assoc. Project Manager

Approved by: _____ Date: _____
Stacey Felts-Bock, OSC

Approved by: _____ Date: _____
Howard Nichols, P.E., Project Manager

This Health and Safety Plan (HASP) must be read and signed by all personnel at the site, including TRC employees and subcontractors.

I have reviewed this HASP, and agree to abide by the requirements contained herein

TRC Employees

Name	Signature	Date

TRC Employees (cont'd)

Name	Signature	Date
Name	Signature	Date
Name	Signature	Date
Name	Signature	Date
Name	Signature	Date
Name	Signature	Date
Name	Signature	Date
Name	Signature	Date
Name	Signature	Date
Name	Signature	Date
Name	Signature	Date

Subcontractors

Name	Signature	Company	Date
Name	Signature	Company	Date
Name	Signature	Company	Date
Name	Signature	Company	Date
Name	Signature	Company	Date
Name	Signature	Company	Date
Name	Signature	Company	Date
Name	Signature	Company	Date
Name	Signature	Company	Date
Name	Signature	Company	Date
Name	Signature	Company	Date

TAILGATE SAFETY MEETING AND SAFETY INSPECTIONS

Pre-Field Activities

- Read and understand this Health & Safety Plan to ensure that all safety measures are considered (i.e., traffic control, overhead lines, etc.).
- Provide the subcontractors with a copy of TRC's HASP and be sure they bring their own HASP related to their field of expertise.
- If performing intrusive work, request from subcontractors a copy of the NJ One Call Mark-Out Confirmation Sheet and include it in your workplan.
- Confirm Utility Companies in HASP match the Utility Companies on the One Call Mark-Out Confirmation Sheet.

In the Field

- Make sure that all TRC field personnel and subcontractors have signed this HASP.
- When the subcontractors arrive, the Site Safety Officer shall perform a daily tailgate safety meeting that includes, but is not limited to, the following:
    - Brief discussion of site history and contaminants of concern.
    - Confirm subcontractors have appropriate H&S training.
    - Discuss the day's scope of work, and the suspected and potential hazards of each task, including chemical hazards and physical hazards (i.e., trip and fall, lifting, overhead obstacles, traffic, etc.).
    - Discuss the required protective personal equipment (PPE); confirm that all personnel have the appropriate PPE and have been trained to use it properly.
    - Discuss communication and chain of command.
    - Discuss emergency actions and emergency evacuation procedures.
    - Document meeting in field book.
    - Always ask if anyone has questions.
    - The meeting should be about 15 minutes long.

- The Site Safety Officer shall perform additional tailgate safety meetings whenever (1) risks or hazards change, (2) new personnel arrive, and (3) site operations warrant training.
- When procedural deficiencies are identified, the Site Safety Officer shall perform additional safety meetings to address the situation.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF APPENDICES

HEALTH AND SAFETY PLAN
EPA IDENTIFICATION NO. NJD980654115
ROCKAWAY BOROUGH WELL FIELD SUPERFUND SITE
KLOCKNER AND KLOCKNER OPERABLE UNIT 3
BOROUGH OF ROCKAWAY, NEW JERSEY

1.0 INTRODUCTION

The purpose of a Health and Safety Plan (HASP) is to establish requirements for protecting the health and safety of personnel from possible exposure to potentially hazardous substances during site activities. This HASP has been developed by TRC Environmental Corporation (TRC) to establish the site-specific health and safety procedures required to minimize potential risk to personnel performing certain activities at the above-referenced site (hereinafter "the Site") (Figure 1).

The provisions of this HASP apply to all personnel who may potentially be exposed to health and safety hazards related to specific activities at the site. All activities will be conducted in accordance with this HASP.

This HASP is written in accordance with all applicable federal, state and local health and safety regulations, including 29 CFR 1910.120, and are based on current knowledge regarding the specific chemical and physical hazards that are known or anticipated to be present at the Site.

TRC will provide subcontractors with a copy of TRC's site-specific HASP that includes a description of the chemical hazards that may be present at the Site. The subcontractor is required to provide a copy of TRC's site-specific HASP to all of its employees and subcontractors who perform work at the Site and who may come into contact with waste or other contaminated materials derived from the Site. The subcontractor's employees and its subcontractors must review TRC's HASP and, when on-site, sign documentation that they have read and understand TRC's HASP. Personnel who cannot or will not sign and/or comply with TRC's HASP will be excluded from on-site activities.

Subcontractors must prepare their own HASP related to their specific expertise and are solely responsible for complying with all OSHA requirements and federal, state and local safety requirements applicable to their work.

2.0 EMERGENCY INFORMATION

The appropriate telephone numbers are listed below for medical emergencies. For non-life threatening emergencies, urgent care facilities can be used if distance permits.

ANY SERIOUS EMERGENCY - DIAL 911

Nearest Hospital: Saint Clare's Hospital, 25 Pocono Road, Denville, NJ 07834
Hospital Emergency Room Telephone Number: 973-625-6063
Hospital Main Telephone Number: 973-625-6000

Step by step directions and a road map to the Hospital is enclosed in Figure 2.

Emergency Numbers	
Rescue Squad	911
Rockaway Borough Police Emergency	(973) 627-1314/911
Fire Emergency	(973) 625-1075/911
Millburn Medical Center	(973) 379-5055
N.J. Poison Control Center	(800) 764-7661
National Response Center and Terrorist Hotline	(800) 424-8802
American Association of National Poison Control	(800) 222-1222
Center for Disease Control	(800) 232-6348
Utility Mark-Out	(800) 272-1000
U.S. Coast Guard National Response Center	(800) 424-8802
Chemtrec (Chemical Spills)	(800) 262-8200

Utilities

Electric	JCP&L	Number:	(800) 646-0400
Gas	New Jersey Natural Gas Company	Number:	(800) 436-7734
Phone	Cablevision	Number:	(888) 827-2507
Water	Rockaway Borough	Number:	(973) 983-2825
Other	Verizon	Number:	(888) 881-8161

If an emergency situation is encountered, the appropriate phone numbers from above should be contacted. If the injuries sustained are such that the injured worker can be moved, and if the injuries are not life threatening, the worker can be transported to Saint Clare's Hospital, following the Route provided on Figure 2.

As soon as practicle, the TRC Project Manager and Office Safety Coordinator should be notified. Other evacuation routes and external communication will likely to be necessary. If conditions arise necessitating any additional emergency responses, TRC will update the HASP.

3.0 TRC CONTACT AND KEY PERSONNEL

3.1 Site Description

In the event of problems that require notification of TRC, the following contacts are listed in order of priority:

Name	Title	Number and Ext.	Cell Number
Howard Nichols	Project Manager	(973) 564-6006 X 303	
Stacey Felts-Bock	Office Safety Coordinator	(973) 564-6006 X 289	(973) 289-8213
BJ Parekh	Assoc. Project Manager	(973) 564-6006 X 336	(732) 485-9594

3.2 Key TRC Personnel

The key TRC personnel involved with this project are listed below.

Project Manager	Site Safety Officer	Field Supervisor	Field Personnel
Howard Nichols	BJ Parekh	Howard Nichols	BJ Parekh
			Brian Ross

* Site Safety Officer and Field Supervisor can be the same TRC personnel.

3.3 Responsibilities

Responsibilities for implementing safe work practices and specifically the requirements of this HASP are described below.

Project Manager

The Project Manager is responsible for controlling all technical work in an environmentally safe manner, assuring that operational hazards are minimized and implementing this during all project task elements. Specific responsibilities include but are not limited to:

(1) Verifying that all personnel involved with this project have read and understand this HASP and have signed the HASP.

(2) Assuring that all personnel involved with this project have attended a briefing or a tailgate safety meeting regarding the contents of the HASP and site-specific hazards prior to performing work.

(3) Determining that sufficient PPE and air monitoring equipment as required by this HASP areavailable.

(4) Assuring that all contractor personnel submit documentation of employee participation in medical, training and drug & alcohol programs (when applicable).

(5) Maintaining a high level of health and safety consciousness among the field personnel.

Office Safety Coordinator (OSC)

The Office Safety Coordinator is responsible for the review, interpretation and modification of the HASP. Specific duties include but are not limited to:

(1) Advising the Project Manager and field personnel on matters relating to health and safety.

(2) Recommending appropriate PPE and air monitoring instrumentation to protect personnel from site hazards.

(3) Conducting field audits to monitor the effectiveness of the HASP and to assure compliance with the HASP.

(4) Performing personal exposure monitoring where required and to determine the adequacy of protective measures and PPE specified by this HASP.

(5) Maintaining contact with the Project Manager and field personnel to regularly evaluate site conditions and any new information that might require modifications to the HASP.

(6) Working with the Project Manager to ensure that sufficient PPE is available onsite.

(7) Conducting briefing meetings and apprise personnel of the contents of the HASP and site hazards.

(8) Conducting accident/incident investigations and preparing accident/incident investigation reports.

Site Safety Officer (SSO)

The Site Safety Officer is responsible for ensuring the Health & Safety guidelines are followed, in addition to monitoring for airborne contaminants when necessary and evaluating new hazards and operation changes. The Site Safety Officer has the authority to correct all noncompliance situations immediately and to stop work in cases of immediate danger. Specific responsibilities include but are not limited to:

(1) Perform daily safety meetings/tailgate safety briefing prior to commencement of work, commencement of a new task and whenever new personnel arrive.

(2) Obtaining the air monitoring instrumentation required and conducting the necessary air monitoring.

(3) Verifying that all PPE and other health and safety equipment is in proper working condition.

(4) Upgrading and downgrading PPE as specified in the HASP.

(5) Notifying the Project Manager and Office Safety Coordinator of all noncompliance and dangerous situations.

(6) Supervising and monitoring the safety performance of all field personnel to ensure required safety and health procedures are followed and correct any deficiencies.

(7) Reporting all accidents/incidents to the Project Manager Office Safety Corodinator.

(8) Initiating emergency response procedures.

(9) Establishing the work zones whenever necessary.

Field Supervisor

The Field Supervisor is responsible for the field operations needed to complete the project. The Field Supervisor may also be the Site Safety Officer. Specific responsibilities include but are not limited to:

(1) Ensuring all equipment including PPE needed for the project is available and properly maintained.

(2) Ensuring field personnel have received the necessary training and Health & Safety briefings before work begins.

(3) Correcting any deficiencies regarding health, safety or operating procedures.

(4) Communicating newly identified hazards or noncompliance issues with the Project Manager, Office Safety Coordinator and the Site Safety Officer.

(5) Reporting any injuries and illnesses to the Project Manager and Office Safety Coordinator.

(6) Stopping work in cases of immediate danger.

Field Personnel

All field personnel are responsible for following the Health & Safety procedures specified in this and work practices specified in applicable operating procedures. Some specific responsibilities include but are not limited to:

(1) Reporting all accidents, incidents, injuries or illnesses to the Field Supervisor

(2) Complying with the requests of the Site Safety Officer.

(3) Immediately communicating newly identified hazards or noncompliance issues to the Field Supervisor or Site Safety Officer.

(4) Stopping work in cases of immediate danger.

4.0 SCOPE OF WORK AND SITE BACKGROUND

4.1 Scope of Work

Sampling (Check all appropriate)

X	Soil		Ground Water
	Sediment		Surface Water
	Sludge		Sanitary Wastewater
	Air		Process Wastewater
X	Other (Specify)	Soil Vapor	

Soil Borings ____

Well Installation X

Soil Excavation X

Pipe Installation X

Vapor Intrusion ____

Other X Explain: Installation and Operation of Soil Vapor Extraction System

TYPE OF SITE (Check all appropriate)

X	Active		Gas Station	X	Industrial Facility
	Inactive		R&D Facility		Power Facility
X	Manufacturing		TSDF Facility		Military Base
X	Private Facility		Other (specify):		

RELEASE HISTORY

	No evidence of soil contamination
X	Suspected or known soil contamination
X	Suspected or known ground water contamination

4.2 General Site Background

The Rockaway Borough Wellfield Superfund Site (#NJD980654115) ("Superfund Site") is located in Rockaway Borough in Morris County, New Jersey, 10 miles north of Morristown and 20 miles northwest of Newark in the north-central portion of the state (Figure 1).

Klockner and Klockner Source Area ("K&K Source Area" or "Site") has been identified as one (1) of the three (3) sources of contamination to the ground water at the Superfund Site. To address the contamination in the ground water, United States Environmental Protection Agency (EPA) has divided the remediation efforts into four (4) different operable units (OU1 through OU4). K&K Source Area has been designated as OU3.

Due to industrial operations at the Klockner Source Area, EPA determined that areas of the Site had the potential to be contaminated with TCE and other constituents. The soil investigation conducted between 1990 through 1995 confirmed that areas of the Site are contaminated with TCE and PCE. At locations adjacent to and below Building 12, TCE was detected in soil at concentrations of up to 90 mg/kg and PCE was detected at concentrations of up to 8.3 mg/kg. PCE was present at elevated concentrations in the soil (up to a maximum concentration of 4.8 mg/kg) adjacent to Building 13. The highest concentration of PCE in soil at the Building 12 property was 23.7 mg/kg, located beneath the Quonset Hut.

Based on the above findings at OU3 the following selected Remedial Actions were directed by EPA to address the ground water contamination source.

1. Soil Vapor Extraction (SVE) of soil contaminated with volatile organic compounds (VOCs) at the Building 12 property; and
2. Excavation and off-site treatment and/or disposal of an estimated 150 cubic yards (yd^3) of VOC contaminated soil at the Building 13 property.

Based upon the results of the pre-design investigation, the final design for the remedial actions has been developed and presented in the Final Remedial Design Report. The Final Design Report was approved by EPA on December 12, 2011. The main components of the remedial actions are listed below:

1. Installation of 10 SVE wells (7-SVE wells inside Building 12 and 3-SVE wells outside Building 12 in the parking lot;
2. Installation of 10 vapor points (VP) (7-VP inside Building 12 and 3-VP outside Building 12);
3. Installation of vaults/manholes for the SVE wells in the parking lot of Building 12;
4. Installation of PVC piping to connect all the SVE wells to the SVE Blower System;
5. Installation of trench in the Building 12 parking lot for the exterior PVC piping;
6. Inside Building 12 the PVC piping will be connected to the SVE wells and will be installed overhead;
7. Installation of the SVE Blower system (trailer);
8. Installation of electric to the SVE system; and
9. Excavation of VOC impacted soil at Building 13.

The proposed remedial actions will be conducted in the parking lots of Buildings 12 and 13 at the Site. These Buildings are functional and are occupied by tenants, therefore no temporary facilities are required at the Site.

This HASP will cover the tasks as discussed above.

5.0 CONTAMINANTS OF CONCERN

The primary contaminants of concern that have been identified or are anticipated at the site and the affected media are listed below. Material Safety Data Sheets are included in Appendix A.

Volatile Organic Compounds	Media
Trichloroethylene (TCE)	Soil & Ground Water
Tetrachloroethylene (PCE)	Soil & Ground Water

Other Compounds	Media

The following is a list of the accepted exposure limits in parts per million (ppm) of the contaminants of concern.

Contaminant of Concern	PEL-TWA	PEL-STEL	TLV-TWA	TLV-STEL	A1	A2	Skin	Ceiling
Tetrachloroethylene (ppm)	25	NA	25	100	No	No	Yes	200
Trichloroethylene (ppm)	NA	NA	50	200	No	No	Yes	200
Lead (mg/m^3)	0.05	NA	0.05	NA	No	No	Yes	NA

PEL-TWA, OSHA = Permissible Exposure Limit-Time Weighted Average
PEL-STEL, OSHA = Permissible Exposure Limit-Short Term Exposure Limit
TLV-TWA, ACGIH = Threshold Limit Value-Time Weighted Average
TLV-STEL, ACGIH = Threshold Limit Value-Short Term Exposure Limit
A1, ACGIH = Known Human Carcinogen
A2 = Suspected Human Carcinogen
Skin = Potential overall exposure through skin absorption, including mucous membranes and eye, either airborne or through direct contact with the substance
Ceiling, ACGIH = Concentration that should not be exceeded during any part of the working exposure
NA = Not Available

6.0 PERSONAL PROTECTIVE EQUIPMENT

Employee safety is a paramount concern for TRC. OSHA Standard 29 CFR 1910.132 requires employers to assess the employer's work area and determine whether hazards are present that require Personal Protective Equipment (PPE). Due to the variety of job sites and situations that TRC may be involved in, it is important that TRC maintain a consistent approach with health and safety procedures. The Project Manager and Field Supervisor are responsible for ensuring that all personnel wear the appropriate PPE.

Protective footwear must be worn when working in the field. Footwear must at a minimum include steel toe and shank protection. Protective footwear must meet ANSI Z41-1991. Additionally, chemical protective footwear may also be required if the potential for contaminated materials exists.

Eye protection must be worn during all sampling activities. Eye protection must include side shields. Prescription lenses worn as eye protection and other protective eyewear must meet ANSI Z87.1.

Hard hats are to be worn when overhead hazards are present. Hard hats must meet ANSI Z89.

Hand protection is to be worn on a task-specific basis. The hand protection must be selected based on the chemical hazards expected to be encountered. In addition, Kevlar gloves or other types of puncture resistant gloves are to be worn by all personnel working with or cleaning glass.

Other PPE, such as coveralls, respiratory protection and hearing protection, will be determined on a task-specific basis.

Before donning PPE, workers will estimate their anticipated work duration. There are several limiting factors that affect the length of work time. These factors must be addressed:

- Air supply consumption
- Permeation and penetration of the Chemical Protective Clothing;
- Ambient temperature;
- Coolant supply (ice or chilled area to keep the worker's body temperature at a normal temperature); and
- Warm supply if the weather is cold, then the Site should have areas equipped with heater to take frequent breaks and to bring the body temperature to normal temperature.

PPE used by personnel, such as vinyl/latex gloves or any punctured gloves, coveralls, earplugs, boot covers will be disposed as regular municipal waste in regular garbage bags. Safety glasses will not be disposed unless they are damaged. The durable PPE will be washed with a solution of water and Alconox and rinsed with clean water. The wash water will be collected and containerized along with the wash water collected from the heavy equipment decontamination. All the decontamination process will be conducted on a decontamination pad, constructed on-site.

Site-Specific PPE

Levels of protection will be upgraded as necessary based on action levels of the site-specific contaminant of concern. Only the Site Safety Officer, with the consent of the Office Safety Coordinator, can downgrade to a lower level.

The contaminants of concern at the Site determine the level of PPE to be worn. For the work to be performed at the Site under this HASP, the following PPE will be worn.

X Level D Modified Protection (for minimal, non-intrusive work)

(a) Boots: Steel-toe and shank protection

(b) Safety Glasses with Side Shields Yes

(c) Hard Hat: Yes X No

(d) Coveralls:

(e) Glove Type: Nitrile or latex

(f) Hearing Protection (if exposed to at least 85 dB of sound) Earplugs or earmuffs

(g) High Visibility Safety Vest: Yes

(h) Other (Specify):

(i) Modifications:

Personnel Decontamination Procedure

Level D: Segregated equipment drop, boot and glove wash, boot and glove rinse, tape removal, boot cover removal, glove removal and field wash.

7.0 AIR MONITORING AND ACTION LEVELS

When appropriate, an air-monitoring program should be implemented to identify areas of elevated airborne contaminant concentrations and to determine the level of the concentrations relative to background. Air monitoring should be performed in the exclusion zone where the field activities are conducted for the safety of the field personnel. Upon exceeding the action levels (listed below), the field operations should cease or be continued with upgraded PPE levels or with dust/vapor control measures. In addition, monitoring should extend out to the support zone and/or out to the perimeter if high levels persist in the exclusion zone.

Monitoring Equipment/Model	Frequency of Surveillance
X PID	Breathing zone during the excavation of VOC impacted soils and during installation of SVE wells and Vapor Probes
X Miniram	Dust monitoring while excavating soil

Dust quality should be monitored with a Miniram or similar instrument. If readings are above the action level, dust control measures will be implemented (i.e., water spraying).

ACTION LEVELS

Direct Reading Instruments

A complex variety of toxic air pollutants (including organic and inorganic vapors, gases or particulates) can be produced at contaminated sites. Direct-reading field instruments will not detect or measure all of these substances. Thus negative readings should not be interpreted as the complete absence of airborne toxic substances. Verification of negative results can only be done by collecting air samples and analyzing them in a laboratory or in an off-site location using portable analyzers and should be considered and determined on a case-by-case basis.

Instrument	Action Level	Action Required
Organic Vapor Monitoring		
Multi-gas PID with 10.6eV Lamp	Between 10 to 50 ppm sustained for 15 minutes or longer in the breathing zone.	Stop operations until levels remain < 10 ppm.
Multi-gas PID with 10.6eV Lamp	Above 10 ppm sustained for 15 minutes or longer in the breathing zone.	Stop operations. Level B necessary
Multi-gas PID with 10.6eV Lamp	Above 50 ppm sustained for 15 minutes or longer in the breathing zone.	Stop operations. Level B necessary

Lower Explosive Limits (LEL)		
Multi-gas PID with 10.6eV Lamp (Multi-Rae Model w/LEL meter)	LEL Levels exceeding 10%.	Stop operations until levels remain <10%.
Dust Monitoring		
Miniram	150 µg/m^3 sustained	Stop operations until levels remain <150 µg/m^3 above background for 15 minutes

(1) See the OSC for action levels using a 10.6eV lamp.
(2) Conduct air monitoring periodically to determine when and if work may be continued. For work to continue above 50 ppm, cease work immediately and upgrade to Level B.
(3) If dust is present above the action level, implement dust control measures such as water spraying

Dust Monitoring

The action level for the dust monitoring of 150 µg/m^3 at the Site is based upon the EPA's Air Quality Standards of PM-10 (particulate matter of 10 microns).

Inorganic Gases and Vapors

The ability to detect and quantify nonspecific inorganic vapors and gases is extremely limited. If specific inorganics are known or suspected to be present, measurements should be made with appropriate measuring device.

Organic Gases and Vapors

Multi-gas PID will be used to monitor air quality while performing the excavation/s. The air will be monitored for the levels of total organic vapors and the lower explosive limits (LEL). As discussed above, operation/s will temporarily cease or be upgraded to the next level of PPE upon exceeding action levels, until safe levels return.

8.0 HAZARD EVALUATION AND MITIGATION

A summary of the potential hazards suspected to be present in work areas is provided below. For life threatening emergencies requiring immediate attention, dial 911.

The field team should make visual observations to help evaluate site hazards and other potentially hazardous conditions (i.e., animals; stressed vegetation; wind directions; labels on containers indicating explosive, flammable, toxic or corrosive materials; conditions conductive to splash or contact with unconfined liquids, or solids).

8.1 Physical Hazards

Existing information for site:
__X__ Detailed _____ Preliminary _____ Unreliable _____ None

Hazardous/Contaminated Material Form(s):
__X__ Solid _____ Liquid _____ Sludge _____ Gas __X__ Vapor

Containment Type(s):
__X__ Drum _____ Tank _____ Pit _____ Debris
_____ Pond _____ Lagoon

Hazardous Material Characteristics:
_____ Volatile _____ Corrosive _____ Reactive _____ Radioactive
_____ Ignitable _____ Toxic _____ Unknown _____ Other (Specify): _____

Routes of Exposure:
__X__ Oral __X__ Dermal __X__ Eye __X__ Respiratory

Potential Health and Safety Hazards

__X__ Heat	__X__ Heavy Equipment
__X__ Cold	__X__ Traffic Hazards
__X__ Falls, Slippage	__X__ Congested Areas
__X__ Noise	__X__ General Construction
_____ Confined Space Entry	__X__ Electrical Hazards
__X__ Cave-Ins	_____ Handling and Transfer of Product
_____ Asphyxiation	__X__ Fire
_____ Oxygen Depletion	_____ Flammable Hazards
_____ Non-Ionizing Radiation	__X__ Biological Hazards (Plant, Insect, Animal)
_____ Other (Specify): _____	

The following general and physical hazards may be associated with this project. TRC's Accident Reporting Form (Appendix B) must be completed if an accident occurs.

1. Potential Hazard: Slips, Trips and Falls

   Procedures to Mitigate Hazard: Exercise caution in all work areas. Be sure of footing when moving through the work area. Avoid stepping or standing on uneven or unsteady surfaces. Clearly delineate open pits, wells and other fall hazards with caution tape and securely cover as appropriate.

2. Potential Hazard: General Construction

   Procedures to Mitigate Hazard: Use cones, signs, sawhorses, caution tape and/or high visibility clothing around work area.

3. Potential Hazard: Struck by heavy equipment.

   Procedures to Mitigate Hazard: Heavy equipment (e.g. excavator for trenching/excavation, drill rig to install SVE wells, and dump/support trucks) should be equipped with back-up alarm or use horn when backing up. Stay clear of operating equipment and rig movement. High visibility vest should be worn around heavy equipment. Always maintain an eye contact with the equipment operator while working in the vicinity of the heavy equipment.

4. Potential Hazard: Underground Utilities

   Procedures to Mitigate Hazard: Underground utilities in and near the work area shall be identified prior to conducting subsurface work. A geophysical survey or hand/soft dig to the appropriate depth should be performed if necessary.

   No underground intrusive work is to commence without an underground utility markout. The One-Call Underground Utility Damage Prevention System (1-800-272-1000) must be notified not less than 3 full business days before and not more than 10 business days prior to beginning of an excavation or demolition.

   Any utilities identified in the excavation area will be carefully exposed. The underground utility will be supported to prevent from collapsing.

5. Potential Hazard: Overhead Utilities and Other Overhead Objects.

   Procedures to Mitigate Hazard: Overhead utilities and other overhead objects in and near the work area shall be identified prior to conducting work. A minimum of 10-foot clearance should be maintained from overhead power lines. The drilling rig, excavator and all other equipment shall be positioned to avoid overhead utility lines in accordance with the distance requirements defined by voltage and local regulations. Use spotter when raising drilling rig mast to confirm clearance of overhead lines and other obstructions.

6. Potential Hazard: Stability of Drill Rig/Operating Equipment

Procedures to Mitigate Hazard: Avoid positioning rig on soft or uneven ground.

7. Potential Hazard: Moving Equipment

   Procedures to Mitigate Hazard: Wear appropriate PPE including hardhat, properly sized gloves, and steel-toed boots. Stay clear of rotating auger or direct push equipment.

8. Potential Hazard: Suspended loads

   Procedures to Mitigate Hazard: Do not walk under suspended loads. Be aware of the travel path of suspended loads.

9. Potential Hazard: Excessive Noise

   Procedures to Mitigate Hazard: Acoustic hazards may be present during soil excavation or drilling activities or SVE system operation. When a noise level prevents conversation in a normal voice at a distance of 3 feet, use proper National Institute of Occupational Safety and Health (NIOSH) approved hearing protection. Personnel will wear hearing protection to avoid the damaging effects of high noise levels that destroy the ability to hear and create a stressful environment. Proper hearing protection such as earplugs or earmuffs must be worn by all personnel around large machinery such as drill rigs and backhoes, or sources associated with the work site, such as vehicles. Noise levels in the work areas that potentially meet or exceed an 8-hour time-weighted average of 85 decibels, will be evaluated by the SSO to ensure proper protection is implemented. The hearing protection must provide a sufficient reduction in the noise exposure to be below 85 decibels. Wear hearing protection within 20 feet of drill rig and other operating equipment.

10. Potential Hazard: Vapors and Dust

    Procedures to Mitigate Hazard: Wear appropriate PPE and wear air-purifying respirator when PID and or the miniram readings exceed action levels. Stop work if hazardous conditions are identified until precautions are taken and work deemed safe to restart. While installing the SVE wells especially inside the building, trenching operations and excavation, the dusty conditions should be suppressed with potable water. While working in the open environment, workers should stay upwind of potential sources of dust and vapors. Calibrate PID and miniram prior to use.

11. Potential Hazard: Lighting

    Procedures to Mitigate Hazard: Work areas must have adequate lighting for employees to perform work and identify hazards, (5-foot candles minimum comparable to a single 70 to 100 watt bulb). Personnel should carry flashlights in all normally dark areas for use in the event of a power failure. Applicable OSHA standards for lighting, 29 CFR 1910.120 (m), shall apply.

12. Potential Hazard: Electrical Power

Procedures to Mitigate Hazard: All electrical power must have a ground fault circuit interrupter as part of the circuit. All equipment must be suitable and approved for the class of hazard. Relevant OSHA standards for electrical safety, 29 CFR 1926 (k), shall apply. The safety measures of operating electrical equipments are further discussed in the Section 8.4

13. Potential Hazard: Fire Protection/Fire Prevention

Procedures to Mitigate Hazard: Operations involving the potential for fire hazards shall be conducted in a manner to minimize the risk. Non-sparking tools and fire extinguishers shall be used or available as appropriate. Sources of ignition shall be removed. When necessary, explosion-proof instruments and/or bonding and grounding will be used to prevent fire or explosion.

14. Potential Hazard: Excavations for the Trench/Cave-ins

Procedures to Mitigate Hazard: All excavations that could potentially expose cave-ins shall be protected by sloping, benching the sides of the excavation, or using a trench box, supporting the sides of the excavation, or placing a shield between the side of the excavation and the work area. Please note that the competent person provided by the awarded contractor will decide the excavation means and methods. The excavated soil will be placed a minimum two (2) feet away from the trench/excavation and not immediately on the edge of the trench. In addition, the field personnel/sub-contractor will not stand on the edge of the excavation.

15. Potential Hazard: Eye Protection

Procedures to Mitigate Hazard: All operations involving the potential for eye injury related to splash, etc., must have eye wash units available. All operation involving the potential eye injury due to flying objects e.g. stone, dusts, tools, machine part, must have eye protection e.g. goggles, face shield, safety glasses, etc.

16. Potential Hazard: Damaged and Deteriorated Buildings

Procedures to Mitigate Hazard: Damaged and deteriorated buildings often contain unguarded walkways, doors, etc. where a fall potential exists. These must be guarded and/or posted to prevent employee use or passage. Areas where work will not be performed will be closed off and posted.

17. Potential Hazard: High or elevated work

Procedures to Mitigate Hazard: All work over 4 feet in elevation (e.g. installation of PVC piping inside the building) or where a fall potential exists will be performed using appropriate ladders or step stools and/or fall protection (i.e., body harness and lifeline). Only trained professionals will be permitted by the competent person at the Site to work in the elevated platforms/ladders.

18. Potential Hazard: Traffic Hazards

Procedures to Mitigate Hazard: The work should be cornered with safety cones and poles. A safety sign asking the moving traffic to slow down and should be placed at a minimum 50 feet from the work area. The traffic should be controlled and watched by a flag man or traffic policemen. Work conducted at this Site is in the parking lots and can be conducted with work area cornered off and high visibility vests.

The following is a list of the potential hazards at the Site.

POTENTIAL HAZARD	**ANTICIPATED RISK**
Inhalation of Dusts	Low to high, keep soils wet to reduce dust, if necessary
Inhalation of Volatile Contaminants	Low to high, perform air monitoring
Ingestion of Contaminants	Low to moderate, use PPE to avoid contact; use washing facilities
Skin and Eye Contact with Contaminants	Low to high, use PPE to avoid contact; use washing facilities
Working with/near Heavy Equipment	Low to moderate, wear safety vests and stay away from swing radius of equipment
Excavation Hazards	Moderate, avoid standing near the perimeter of the excavation and do not enter the excavation if >4 feet
Noise Exposure	Low to moderate, use hearing protection
Tripping Hazards	High, avoid hazards; employ good housekeeping
Heat Stress	Depends on ambient temperature, drink fluids and monitor heart rate
Cold Exposure	Depends on ambient temperature, wear warm clothing; if clothing gets wet, remove and replace with dry clothing
Biological Hazards	Low, identify nearby plants
Flammable Hazards	Low to moderate, use LEL meters and ventilate areas with LEL readings >10%; be aware when using gasoline generators
Electrical Hazards	Low to high; markout underground utilities; be aware of overhead power lines and maintain a safe distance; use ground fault circuit interrupters on portable power tools
Traffic Hazards	Moderate to high, wear safety vests and use cones, stay aware
Lighting Hazards	Low, ensure proper illumination

Hazard Identification/Ranking

Task: Soil Excavation Low ____ Medium ____ High X

Task: Installation of PVC piping Low X Medium ____ High ____

Task: Install Soil Vapor Extraction Wells Low ____ Medium X High ____

Task: Installation of Soil Vapor Points Low ____ Medium X High ____

Task: Installation of Soil Vapor System Low X Medium ____ High ____

Low = non-intrusive work, exposure to contaminants possible.
Medium = intrusive work, possible safety hazards with powered tools and heavy equipment, exposure to contaminants possible.
High = intrusive work, possible safety hazards with equipment, exposure to contaminants very probable.

8.2 Chemicals Used by TRC

The following is a list of the chemicals to be brought on-site and used by TRC personnel (check all that apply):

	Acetone for decontamination
	Hexane for decontamination
	Nitric Acid for decontamination
	Methanol for sample preservation
	Isobutylene for PID calibration
	Isobutylene for PID calibration

	H_2SO_4 for sample preservation
	HNO_3 for sample preservation
	HCL for sample preservation
	Gasoline for generators

MSDSs for these chemicals are included in Appendix A.

8.3 Biological Hazard

The biological hazards anticipated at the site are noted below.

____ Ticks and Chiggers

Ticks and chiggers may be present in vegetated areas during the spring, summer and fall seasons. Preventative measures include protective clothing; head/hair protection; and the use of insect repellant containing DEET on all exposed areas and coveralls. Workers should check their bodies thoroughly for ticks and should bathe soon after returning home. Remove any ticks carefully, using a gentle, firm, tugging motion with fine tweezers. Do not kill the tick before it has been removed. Workers should save the ticks and monitor their bites, checking for a rash and other symptoms (up to about eight weeks after the bite).

X Toxic Effects from Plants

Poison ivy, poison oak and poison sumac may be present during the spring, summer and fall seasons. Contact with it should be avoided, however, if one has come in contact with it, the affected skin area should be washed thoroughly with soap and cool water. Care should be taken when handling clothing or any other items that have come in contact with poison ivy. If an allergic reaction occurs, a physician's advice should be sought.

X Animal Bites or Stings

Animal bites or stings are usually nuisances (localized swelling, itching and minor pain) that can be handled by first aid treatment. The bites of certain snakes, lizards and spiders contain sufficient poison to warrant medical attention. There also are diseases that can be transmitted by animal bites that will require professional medical attention. Examples are rabies (mainly from dogs, skunks, raccoons, and foxes), Lyme Disease (from ticks), and West Nile Disease or encephalitis (from mosquitoes).

The biggest hazard and most common cause of fatalities from animal bites and inspect stings (particularly bees, wasps and spiders) is a sensitivity reaction. Anaphylactic shock due to stings can lead to severe reactions to the circulatory, respiratory, and central nervous system and it can also result in death.

Workers who are bitten by an animal or stung by an insect must immediately notify the OSC or his designated site representative.

X Bloodborne Pathogens

All employees trained in first aid may have exposure to infectious materials.

8.4 Electrical Hazards and Safety Measures

The objective of this protocol is to control potential electrical hazards that may exist while conducting work activities at the project sites.

The following safe work practices must be followed:

- Always call an electrician in case of need of electrical work except for changing 110-volt A.C. light bulbs, resetting breakers or working on automotive type circuits.

- All electrical wiring of equipment must be considered "live" and dangerous. A shock from 110 volts can be fatal.

- All permanent electrical wires must be hung on insulators, messengers, in conduit or trays. All temporary electrical wires must be hung so they are not in mud or water. GFCIs will be used on all electrical wiring.

• Never handle electrical wires that are "hot" or "live" while standing or sitting in a wet place without taking extra precautions to obtain insulation from the ground. Be sure conditions are safe before starting work.

• Do not place electric bulbs where drops of water can hit them. Do not spray down electrical equipment.

• Electricians shall not touch, install, or attempt to repair any electrical equipment unless they are fully familiar with it; until it is locked and tagged out; and until they are positive it is safe. Never take your first chance with electricity.

• Do not touch "live" wires because you could become a conductive path.

• Do not open a manual switch to disconnect power from a running motor except in cases of extreme emergency where the regular starter is not functioning.

• Cultivate the habit of turning your face away when opening or closing switched on circuit breakers or when doing anything that could cause an arc or flash. Never turn your face and then grope for a switch handle.
- Never close an electrical switch slowly or hesitatingly. Close it quickly and positively;
- Remember that arc burns may be severe; and
- Do not remove a fuse from any circuit until the switch has first been opened.

• In case of a blown fuse or tripped circuit breakers, do not restore power until a thorough check has been made of the equipment to prevent closing into a fault.

• All electrical equipment shall be installed in such a manner so as to be readily and safely accessible to authorized employees to maintain and repair. Rails, wooden platforms, insulating mats or electrically non-conductive material shall guard such equipment wherever necessary.

• Only qualified electricians shall perform all repairs or adjustments or other work on any type of electrical equipment.

• Electrical equipment and wiring shall be inspected systematically and documented at regular intervals to ensure a safe operating condition. Defective equipment shall be repaired or replaced at once.

• Fuses or equivalent protective devices of the correct type and capacity shall be installed on all electrical equipment to protect against excessive overloads or other failures.

• Switches and circuit breakers shall be installed so that they are readily accessible and can be operated without danger of contact with moving or "live" parts.

• Switchboard shall be well lighted for personnel operating in front of board and for maintenance and repair. The rear of the switchboards shall be so guarded as to prevent anyone getting near them and, if possible, shall be enclosed.

• All rooms or building that contain switchboards or control equipment shall be kept free of debris and refuse at all times.

• All junctions on switch boxes must have covers in place before starting operation.

• When repairs are finished or before an employee closes the switch, he shall make certain that the closing will not start a fire or endanger a fellow employee.

• Wire, pieces of wire, or other conducting materials shall not be used as a substitute for properly designed fuses. Where circuit breakers are used, they shall be maintained in proper operating condition and be properly adjusted.

• No employee working in an elevated position on electrical equipment shall do so without using an approved safety belt and lifeline, unless there are proper guardrails around such elevated positions.

• Hand held electric tools should not be operated at high potential voltages.

• All electrical installations, temporary or permanent shall comply with the applicable provisions of the national electrical safety code.

• Electrical wire, conduit, apparatus, and components of equipment shall be approved or listed by the Underwriters Laboratories, Inc., or factory mutual laboratories, for the specific application. Extension cords shall be 3-wire grounded types listed by the Underwriters Labs, Inc. The rated load shall not be exceeded.

• A ground-fault interrupter (GFI) program shall protect all 115-, 120-, and 220-volt, singlephase receptacle outlets used for construction operations. This requirement includes receptacles on stationary and portable systems.

• Always use a fiberglass or non-conductive ladder when doing electrical work.

Grounding:

• "Grounding" means making an intentional permanent connection to the general mass of earth in such a manner as will insure at all times the immediate discharge of electric energy to the earth without danger.

• All equipment that may become accidentally charged with electric current shall be effectively grounded.

• Ground wire connections to the apparatus shall be made by means of an approved clamp or terminal soldered or welded to the ground wire and securely bolted to the apparatus, where its removal will be unnecessary for inspection or repairs.

• Wherever possible, ground wires shall be installed in such a manner that they may be inspected for continuity and be protected from mechanical injury.

• All fence enclosures surrounding switchgear, transformers, etc. shall be effectively grounded. Three feet clearance shall be provided between transformer and fence.

• Installation of electrical equipment is not to be considered complete until it has been properly and effectively grounded.

ELECTRICAL LOCKOUT PROCEDURES

This section is prepared in accordance with 29 CFR 1926.417. A Lockout and tagging of circuits at all electrical equipment must be locked out according to the following procedure prior to maintenance activities:

• Inform operator and/or foreman of intent to shutdown equipment;
• Turn off equipment;
• Lockout equipment with lock, lockout hasp, and tag. Sign and date tag. Keep key;
• Attempt to start equipment; if equipment remains energized, report to foreman or electrician and do not proceed with maintenance activity. If equipment is de-energized, proceed with maintenance as planned;
• When maintenance is finished, clear area of tools and debris;
• Inform operator and/or foreman of intent to start equipment;
• Make sure personnel are clear of equipment;
• Test run; and
• Replace tag and lockout on lockout board.

8.5 Trenching/Excavation Hazards and Safety Measures

A competent person assigned by the on-site contractor will be responsible to conduct excavation at the site. The on-site contractor will design the means and methods for excavation. Means and methods for excavation should be based upon the soil type (Class A, B, C, and D) at the referenced Site. The excavation design may include but not limited to benching, shoring, sloping and or trench boxes. Any excavated soil should be placed at a minimum two (2) feet away from the edge and not on the edge. To prevent any cave-in personnel will not be allowed to stand on the edge of the trench/excavation.

No one will be allowed to enter the excavation until and unless the excavation is secured by engineering means and methods.

The open trench or excavation will be secured with cones, retractable cone bars, road plates and/or high visibility fence to prevent any kind of fall/trip accidents.

8.6 PVC Piping Installation Hazards and Safety Measures

A competent person assigned by the on-site contractor will be responsible to install the PVC piping at the Site.

The PVC piping installed inside the building will be fastened to the stringer/girder or building structures. The installation inside the building will require elevated platforms or mechanical ladders. The on-site contractor will be responsible to make sure the person working on elevated platforms is equipped with harness and other necessary safety gears to prevent any falls. TRC personnel overseeing this operation will not be allowed to go on the elevated platform and will be required to have proper head protection from any falling tools.

The PVC piping to be installed outside the building will be in the trenches. The potential hazards are slip and fall into the trench; standing on the unprotected edge of the trench; bending; and getting hit by the long PVC pipes. TRC personnel shall be required to stay away from the unprotected edges of the trench, any bending should be done by knees and not by the back and be vigilant to prevent getting hurt by any objects.

The on-site contractor will be responsible to follow necessary OSHA safety standards and contractor's HASP.

8.7 Cold Stress

The objective of this protocol is to control potential cold stress that TRC personnel may get exposed due to harsh weather conditions while conducting work activities at TRC project sites.

The following safe work practices must be followed:

- Recognize the environmental and workplace conditions that lead to potential cold-induced illnesses and injuries.
- Learn the signs and symptoms of cold-induced illnesses/injuries and what to do to help the worker.
- Train the workforce about cold-induced illnesses and injuries.
- Select proper clothing for cold, wet, and windy conditions. Layer clothing to adjust to changing environmental temperatures. Wear a hat and gloves, in addition to underwear that will keep water away from the skin (polypropylene).
- Take frequent short breaks in warm dry shelters to allow the body to warm up.
- Perform work during the warmest part of the day.
- Avoid exhaustion or fatigue because energy is needed to keep muscles warm.
- Use the buddy system (work in pairs).
- Drink warm, sweet beverages (sugar water, sports-type drinks). Avoid drinks with caffeine (coffee, tea, or hot chocolate) or alcohol.
- Eat warm, high-calorie foods like hot pasta dishes

8.8 Heat Stress

The objective of this protocol is to control potential heat stress that TRC personnel may get exposed due to harsh weather conditions while conducting work activities at TRC project sites.

The following safe work practices must be followed:

- General ventilation - dilutes hot air with cooler air (ideally, bringing in cooler outside air) and in is the most cost effective).
- Air treatment/air cooling - differs from ventilation because it reduces the temperature of the air by removing the heat (and sometimes humidity) from the air.
- Heat conduction blocking - methods include insulating the hot surface that generates the heat and changing the surface itself.
- Acclimatize workers - by exposing them to work in a hot environment for progressively longer periods.
- Fluids - Ample supplies of liquids should be placed close to the work area.
- Reduce the physical demands - by reducing physical exertion such as excessive lifting, climbing, or digging with heavy objects.
- Provide recovery areas - such as air-conditioned enclosures and rooms and provide intermittent rest periods with water breaks.
- Reschedule hot jobs - for the cooler part of the day, and routine maintenance and repair work in hot areas should be scheduled for the cooler seasons of the year.
- Reflective clothing - which can vary from aprons and jackets to suits that completely enclose the worker from neck to feet, can reduce the radiant heat reaching the worker.
- Auxiliary body cooling Ice vests - , though heavy, may accommodate as many as 72 ice packets, which are usually filled with water.

8.9 General Safety Measures

All employees will wash their hands immediately after potential exposure to infectious materials.

No eating, drinking, chewing gum, tobacco smoking, applying cosmetics, lip balm or any other practice which increases the tendency for hand-to-mouth contact shall be prohibited within the contaminated zone(s) and prior to washing hands and face within the contamination reduction corridor or decontamination line.

Medicine and alcohol can intensify the effects of exposure to toxic chemicals. Alcohol, Caffeine products and certain medications can contribute to and exacerbate the effects of heat stress. Personnel during site activities should not take prescription and non-prescription drugs when the potential for absorption, inhalation or ingestion of toxic substances exists, unless specifically approved by a qualified physician.

Contact with surfaces known or suspected of being contaminated should be avoided during on-site activities. Avoid walking through puddles, mud, or discolored surfaces; kneeling on ground; leaning, sitting, or placing equipment on drums.

All equipment and environmental and working surfaces will be cleaned and decontaminated with an appropriate disinfectant immediately or as soon as feasible when surfaces are overtly contaminated or after any spill of blood or other potentially infectious materials.

After an exposure incident, a confidential medical evaluation and follow-up will be immediately available to the exposed individual. Arrangements for the medical evaluation should be coordinated with the OSC.

9.0 SITE CONTROL MEASURES

If warranted by the Project Manager and Office Safety Coordinator, zones may be established to prevent or minimize exposure of unauthorized personnel to hazards by establishing boundaries to reduce migration of contaminants from designated work areas into clean areas. These zones are designated as the Support Zone, the Contamination Reduction Zone and the Exclusion Zone. The zones will be identified during safety briefings and may be clearly marked by traffic cones, caution tape, barricades, signs or other means.

9.1 Support Zone

The Support Zone is the clean area where the possibilities of encountering hazardous materials or conditions are minimal (Figures 3 & 4). Therefore, personal protective and respiratory equipment are not necessary. Inside the Support Zone, the following will be available: an effective means of communication, first-aid supplies, fire extinguisher, drinking water and other appropriate support facilities. The Support Zone shall also serve as the main point of contact for the visitor check-in and initiation of emergency services when necessary.

Communications using radios or other means must be maintained between personnel performing the work at all times. Emergency communications should be prearranged in case of radio failure.

9.2 Contamination Reduction Zone

The Contamination Reduction Zone is the area where equipment and personnel are decontaminated after leaving the Exclusion Zone (Figures 3 & 4). Personnel will remove and/or decontaminate PPE and place it in appropriate containers. Site vehicles and equipment will also be decontaminated in the Contamination Reduction Zone. The Contamination Reduction Zone will consist of a temporary decontamination area as discussed in the previous section, a means of washing protective equipment, site equipment; containers for liquids, solids and PPE; first-aid supplies; an eyewash kit; and a fire extinguisher. The proposed decontamination pad will be built with a 14-millimeter thick polyethylene sheet in the contaminant reduction zone (Figures 3 & 4). It is anticipated that the equipment used for the pre-investigation will be a Geoprobe and backhoe with a small bucket. The Geoprobe will be decontaminated with a steam wash on the decontamination pad and all the water will be collected and containerized. The wash water will be analyzed in accordance with the disposal facility's protocol and will be disposed accordingly. The backhoe will be decontaminated with a steam wash and will be washed in the exclusion zone on top of the excavation, to reduce the waste stream. The wash water will be allowed to flow and drain into the trench and will not be collected or containerized. Because the wheels/tracks of the equipment will not come in contact with contaminated soil, they will not be decontaminated. All equipment will be cleaned by the contractor prior to entering the Site.

The acetate sleeves used to collect the soil samples will be disposed along with the PPE as regular waste in a regular garbage bags.

Eating, drinking, chewing gum or tobacco smoking or any activity that increases the probability of hand-to-mouth transfer and ingestion of material is prohibited in the Contamination Reduction Zone.

Personnel performing decontamination operations will be provided with appropriate personal protective equipment, including face shield, rain suits or chemical resistant PPE as needed, water/chemical resistant boot covers, gloves and hearing protection.

9.3 Exclusion Zone

The Exclusion Zone includes the designated work areas at the site. (Figures 3 & 4) Only authorized, trained and qualified personnel with the appropriate personal protective equipment shall be admitted into the Exclusion Zone.

Work activities within the Exclusion Zone pose the greatest possibility of exposure to personnel and equipment. The Site Safety Officer shall be responsible for controlling the access points. The Exclusion Zone will be clearly marked with flagging, barricade tape, traffic cones or other signals to limit access.

Eating, drinking, chewing gum or tobacco, smoking, or any practice that increases the probability of hand-to-mouth transfer and ingestion of material is prohibited in the Exclusion Zone.

9.4 Hazard Communication

The proposed pre-design investigation is going to involve soil borings, and trenching/excavation. The possible hazard during the installation of borings and trench is accidental damage to the utilities. However, prior to the pre-design investigation utilities will be marked out by the utility providers. Therefore, the possibility of any mass evacuation, and thus the route, is not required.

10.0 MEDICAL SURVEILLANCE

All personnel participating in this activity must comply with the Medical Surveillance requirements of 29 CFR 1910.120 (f). Additionally, all personnel must be certified as medically fit to use a respirator in accordance with 29 CFR 1910.134 (Respiratory Protection) if Level C or higher PPE is used. Records including fit testing results and medical form stating that the person is fit to wear respirator are kept at TRC's office for TRC personnel.

11.0 HEALTH AND SAFETY PROGRAMS

11.1 Personnel Training and Respirator Protection

All personnel involved in the field work, including subcontractors conducting field activities, must be trained in accordance with OSHA's Hazwoper requirements in 29 CFR 1910.120 unless otherwise designated as exempt personnel described below. Personnel required to meet the training requirements must present evidence of this training when requested. The subcontractor is also solely responsible for complying with all applicable OSHA requirements and all other federal, state and local safety requirements for their field of expertise.

In addition, an annual 8-hour minimum refresher course after the initial training shall be provided to all field personnel.

All personnel must be certified as medically fit to use a respirator in accordance with 29 CFR 1910.134 (Respiratory Protection) if Level C or higher PPE is used. Records including fit testing results and medical form stating that the person is fit to wear respirator must be presented when requested.

11.2 Exempt Personnel

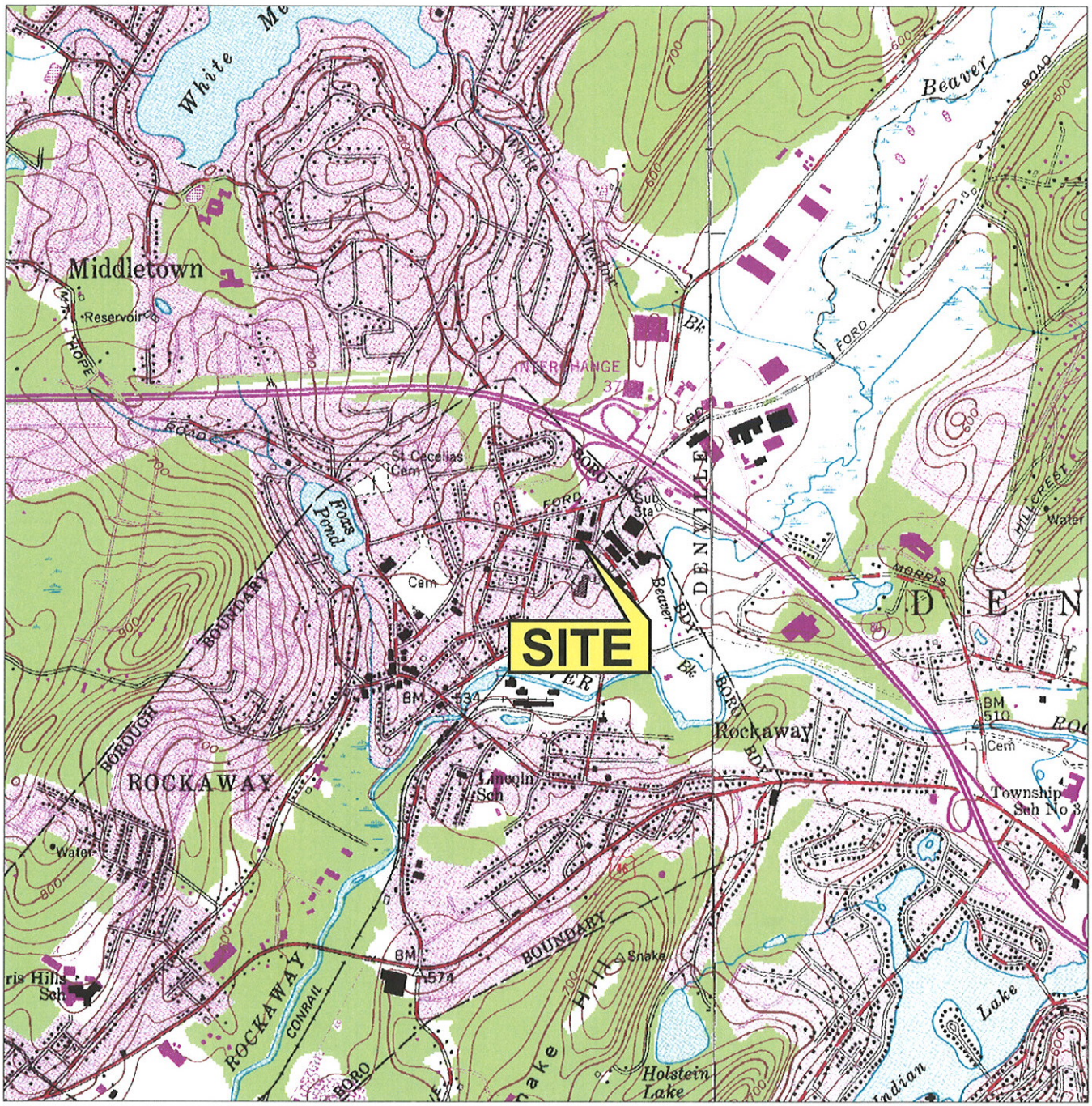
Those personnel working on the construction site in the support zone, but not entering the exclusion zone are exempt to these training requirements. Exempt personnel requesting access to the work areas could include, but not limited to, personnel making deliveries or performing repairs to utilities, public or government officials or untrained visitors. Individuals from these groups would not be required to comply with the OSHA training requirements.

Observation areas will be upwind from site operations, as decided on the basis of predominant wind directions. Weather conditions or site activities may restrict access to observation areas. Approvals for exempting personnel and decisions on access limitation for other personnel will be handled on a case-by-case basis by the SSO in consultation with the Field Supervisor and Project Manager.

11.3 Tailgate Safety Meetings and Safety Inspections

A safety meeting shall be conducted at least daily or (1) whenever risks or hazards change, (2) whenever new personnel arrive and (3) when site operations warrant training. Safety meetings shall be conducted by the SSO or another qualified individual. Where procedural deficiencies are identified, additional safety meetings will be conducted to address the situation. The following items are to be addressed during the meetings including review of the day's scope of work, suspected hazards, required PPE, communication and chain of command, decontamination procedures and emergency procedures.

The SSO will inspect the site daily to identify potential hazardous conditions or work areas. The OSC will visit the site periodically to evaluate whether work operations are being conducted in compliance with the protocols and procedures outlined in this HASP.



SOURCE: DOVER AND BOONTON, N.J. QUADRANGLES, 1954, PHOTOREVISED 1981
7.5 MINUTE SERIES (USGS TOPOGRAPHIC MAP)

N

0 2000 FT.

APPROXIMATE SCALE

NEW JERSEY

QUADRANGLE LOCATION

TRC ENVIRONMENTAL CORP.
57 East Willow Street
Millburn, New Jersey 07041

SITE LOCATION MAP

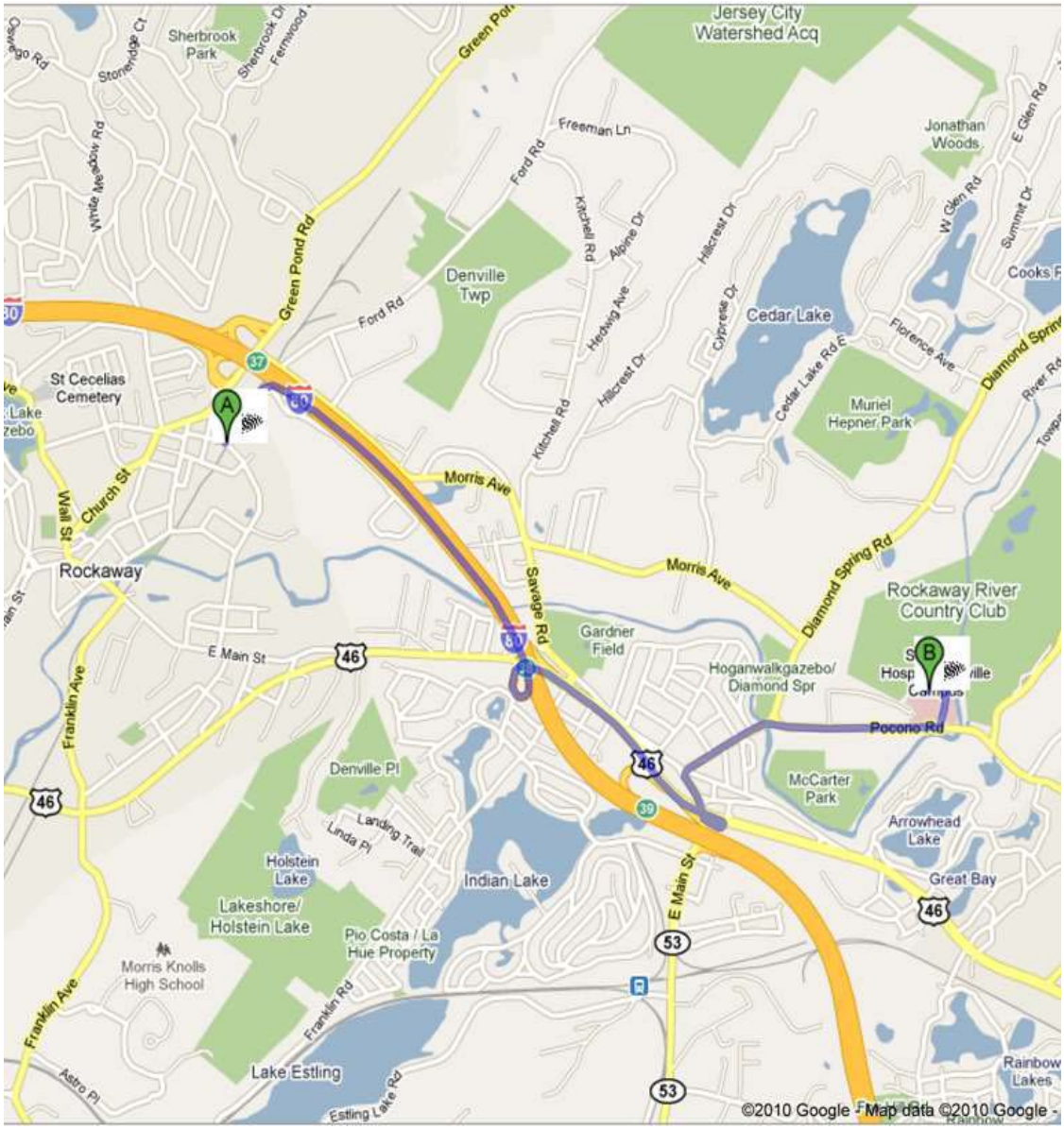
KLOCKNER PROPERTY – ROCKAWAY, NJ

JOB NO.: 163292

BJ/LB	DATE: JANUARY 2010	FIGURE: 1

M:\CAD FILES\VISION PROJECTS\163292\163292-FIGURE 1 SLM.DWG 06/04/2010 12:01:53PM TAB: LAYOUT

Figure 2



Directions to St Clares Hospital
25 Pocono Road, Denville,
NJ 07834 - (973) 625-6000
3.5 mi – about **8 mins**

1.	Head **north** on **Oak St** toward **Hibernia Ave**	go 0.1 mi total 0.1 mi

	2. Turn **right** at **Hibernia Ave**	go 0.1 mi total 0.2 mi
	3. Take the ramp onto **I-80 E** About 1 min	go 1.1 mi total 1.4 mi
	4. Take exit **38** to merge onto **US-46 E** toward **NJ-53/Denville** About 2 mins	go 1.0 mi total 2.3 mi
	5. Turn **right** toward **E Main St/NJ-53 N**	go 92 ft total 2.3 mi
	6. Turn **right** toward **E Main St/NJ-53 N**	go 322 ft total 2.4 mi
	7. Turn **right** at **E Main St/NJ-53 N**	go 0.1 mi total 2.5 mi
	8. Turn **right** to stay on **E Main St/NJ-53 N**	go 79 ft total 2.5 mi
	9. Continue onto **Diamond Spring Rd**	go 0.3 mi total 2.8 mi
	10. Slight **right** at **Pocono Rd** About 1 min	go 0.5 mi total 3.3 mi
	11. Turn **left** About 1 min	go 0.2 mi total 3.5 mi

St Clares Hospital
25 Pocono Road, Denville, NJ 07834 - (973) 625-6000

ELM STREET

APPROXIMATE LOCATION OF SVE SYSTEM TRAILER AND GAC VESSELS

PROPOSED 6' TALL PRIVACY FENCE AND SOUND BARRIER

SUPPORT ZONE

DECONTAMINATION PAD

CONTAMINATION REDUCTION ZONE

SEE DETAIL 3

LOADING BAY

SHIPPING ROOM

SHELF STORAGE

STORAGE

BUILDING 12

SCALE ROOM

ALLEYWAY

QUONSET HUT

PAVED PARKING AREA

OAK STREET COMMONS

EXCLUSION ZONE

CONTAMINATION REDUCTION ZONE

DECONTAMINATION PAD

SUPPORT ZONE

SEE DETAIL 1

SEE DETAIL 2

SEE DETAIL 8

VP-1 VP-2 VP-3 VP-4 VP-5 VP-6 VP-7 VP-8 VP-9 VP-10 VP-11 VP-12 VP-13 VP-14 VP-15 VP-16 VP-17 VP-18 VP-19 VP-20 VP-21 VP-22 VP-23 VP-24 VP-25

SVE-1 SVE-2 SVE-3 SVE-4 SVE-5 SVE-6 SVE-7 SVE-8 SVE-9 SVE-10 SVE-11

VET-1

A A' B B'

6" SCH 80 PVC

4" SCH 80 PVC

4" SCH 40 PVC

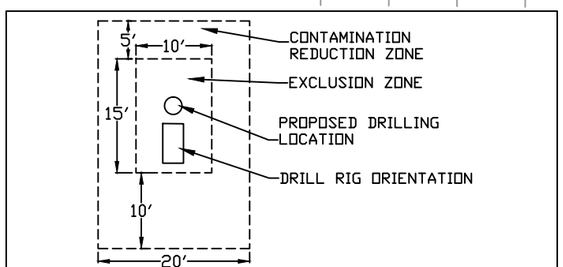
6" SCH 40 PVC

0 20 FT.

APPROXIMATE SCALE

LEGEND

- PROPOSED SVE WELL LOCATION
- EXISTING VAPOR PROBE
- PROPOSED VAPOR PROBE
- EXTRACTION TRENCH
- VET RISER
- PROPERTY LINE
- HEADER PIPE #1
- CONTROL MEASURE FOR TRENCHES
- HEADER PIPE #2
- HEADER PIPE #3
- BUILDING
- HEADER PIPE CONVERGING AREA



TYPICAL SITE CONTROL MEASURES AT SVE WELLS AND VAPOR POINTS DETAIL

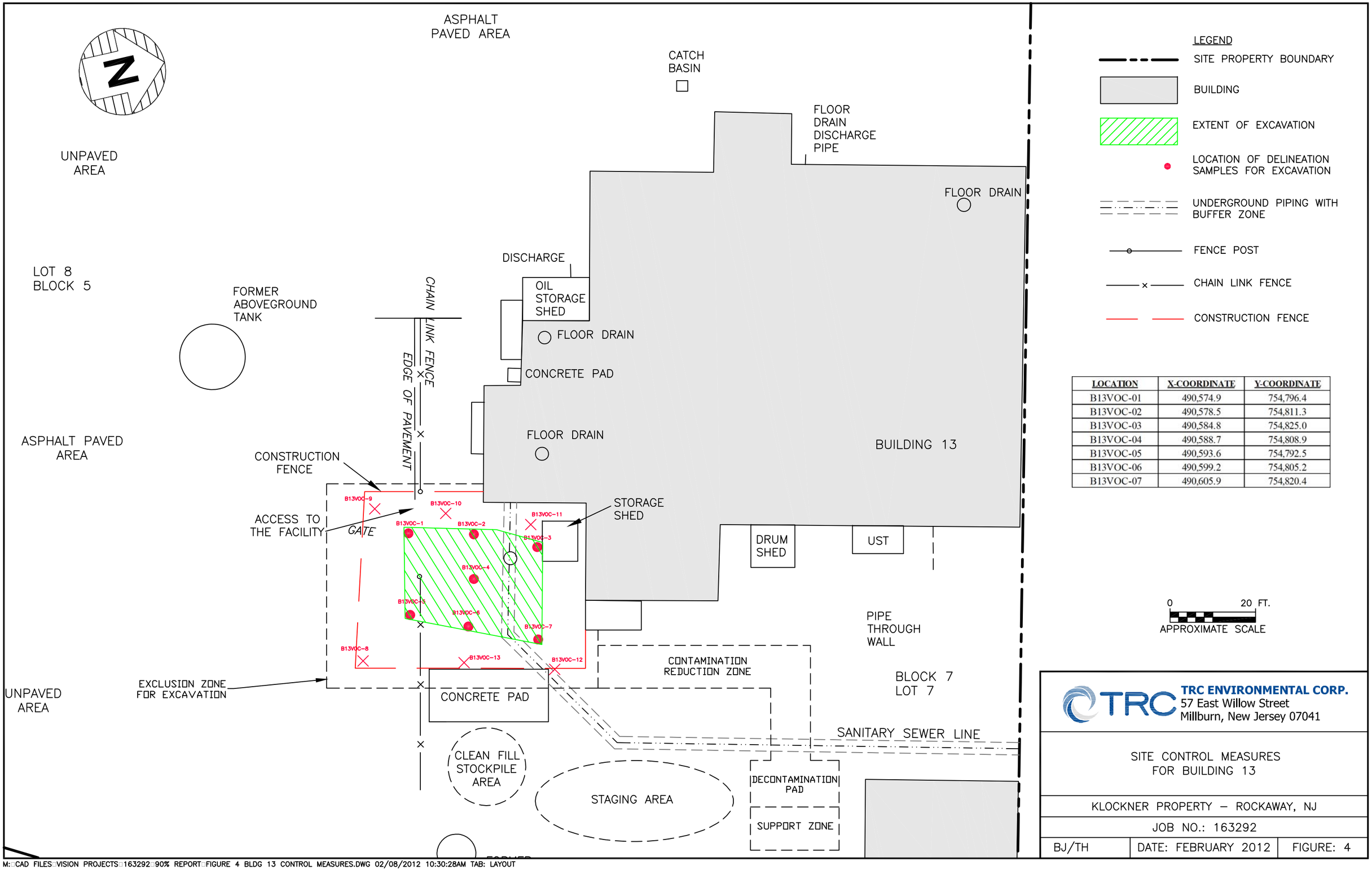
TRC ENVIRONMENTAL CORP.
57 East Willow Street
Millburn, New Jersey 07041

SITE CONTROL MEASURES FOR BUILDING 12

KLOCKNER PROPERTY – ROCKAWAY, NJ

PREPARED BY: BJP/TH	DATE: FEBRUARY 2012
JOB NO.: 163292	FIGURE: 3

M:\CAD FILES\VISION PROJECTS\163292\90% REPORT\FIGURE 3 BLDG 12 CONTROL MEASURES.DWG 08/24/2012 03:41:46PM TAB: SITE PLAN -- 11x17



LOCATION	X-COORDINATE	Y-COORDINATE
B13VOC-01	490,574.9	754,796.4
B13VOC-02	490,578.5	754,811.3
B13VOC-03	490,584.8	754,825.0
B13VOC-04	490,588.7	754,808.9
B13VOC-05	490,593.6	754,792.5
B13VOC-06	490,599.2	754,805.2
B13VOC-07	490,605.9	754,820.4

TRC ENVIRONMENTAL CORP.
57 East Willow Street
Millburn, New Jersey 07041

SITE CONTROL MEASURES FOR BUILDING 13

KLOCKNER PROPERTY – ROCKAWAY, NJ

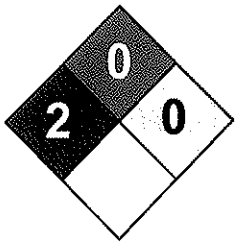
JOB NO.: 163292

BJ/TH | DATE: FEBRUARY 2012 | FIGURE: 4

M:\CAD FILES\VISION PROJECTS\163292\90% REPORT\FIGURE 4 BLDG 13 CONTROL MEASURES.DWG 02/08/2012 10:30:28AM TAB: LAYOUT

APPENDIX A

MATERIAL SAFETY DATA SHEETS (MSDS)



Health	2
Fire	0
Reactivity	0
Personal Protection	G

Material Safety Data Sheet
Tetrachloroethylene MSDS

Section 1: Chemical Product and Company Identification

Product Name: Tetrachloroethylene

Catalog Codes: SLT3220

CAS#: 127-18-4

RTECS: KX3850000

TSCA: TSCA 8(b) inventory: Tetrachloroethylene

CI#: Not available.

Synonym: Perchloroethylene; 1,1,2,2-Tetrachloroethylene; Carbon bichloride; Carbon dichloride; Ankilostin; Didakene; Dilatin PT; Ethene, tetrachloro-; Ethylene tetrachloride; Perawin; Perchlor; Perclene; Perclene D; Percosolvel; Tetrachloroethene; Tetraleno; Tetralex; Tetravec; Tetroguer; Tetropil

Chemical Name: Ethylene, tetrachloro-

Chemical Formula: C2-Cl4

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call: 1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Tetrachloroethylene	127-18-4	100

Toxicological Data on Ingredients: Tetrachloroethylene: ORAL (LD50): Acute: 2629 mg/kg [Rat]. DERMAL (LD): Acute: >3228 mg/kg [Rabbit]. MIST(LC50): Acute: 34200 mg/m 8 hours [Rat]. VAPOR (LC50): Acute: 5200 ppm 4 hours [Mouse].

Section 3: Hazards Identification

Potential Acute Health Effects:
Hazardous in case of skin contact (irritant), of inhalation. Slightly hazardous in case of skin contact (permeator), of eye contact (irritant), of ingestion.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Classified A3 (Proven for animal.) by ACGIH. Classified 2A (Probable for human.) by IARC, 2 (anticipated carcinogen) by NTP. MUTAGENIC EFFECTS: Mutagenic for bacteria and/or yeast. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to kidneys, liver, peripheral nervous system, respiratory tract, skin, central nervous system (CNS). Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation occurs.

Skin Contact:
In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek medical attention.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention if symptoms appear.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention if symptoms appear.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: Not applicable.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions: Not applicable.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.

Large Spill:
Absorb with an inert material and put the spilled material in an appropriate waste disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Do not ingest. Do not breathe gas/fumes/ vapor/spray. Avoid contact with skin. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents, metals, acids, alkalis.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value.

Personal Protection:
Safety glasses. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 25 (ppm) from OSHA (PEL) [United States] TWA: 25 STEL: 100 (ppm) from ACGIH (TLV) [United States] TWA: 170 (mg/m3) from OSHA (PEL) [United States] Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Ethereal.

Taste: Not available.

Molecular Weight: 165.83 g/mole

Color: Clear Colorless.

pH (1% soln/water): Not available.

Boiling Point: 121.3°C (250.3°F)

Melting Point: -22.3°C (-8.1°F)

Critical Temperature: 347.1°C (656.8°F)

Specific Gravity: 1.6227 (Water = 1)

Vapor Pressure: 1.7 kPa (@ 20°C)

Vapor Density: 5.7 (Air = 1)

Volatility: Not available.

Odor Threshold: 5 - 50 ppm

Water/Oil Dist. Coeff.: The product is more soluble in oil; log(oil/water) = 3.4

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility:
Miscible with alcohol, ether, chloroform, benzene, hexane. It dissolves in most of the fixed and volatile oils. Solubility in water: 0.015 g/100 ml @ 25 deg. C It slowly decomposes in water to yield Trichloroacetic and Hydrochloric acids.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Incompatible materials

Incompatibility with various substances: Reactive with oxidizing agents, metals, acids, alkalis.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:
Oxidized by strong oxidizing agents. Incompatible with sodium hydroxide, finely divided or powdered metals such as zinc, aluminum, magnesium, potassium, chemically active metals such as lithium, beryllium , barium. Protect from light.

Special Remarks on Corrosivity: Slowly corrodes aluminum, iron, and zinc.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Eye contact. Inhalation. Ingestion.

Toxicity to Animals:
WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE. Acute oral toxicity (LD50): 2629 mg/kg [Rat]. Acute dermal toxicity (LD50): >3228 mg/kg [Rabbit]. Acute toxicity of the vapor (LC50): 5200 4 hours [Mouse].

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: Classified A3 (Proven for animal.) by ACGIH. Classified 2A (Probable for human.) by IARC, 2 (Some evidence.) by NTP. MUTAGENIC EFFECTS: Mutagenic for bacteria and/or yeast. May cause damage to the following organs: kidneys, liver, peripheral nervous system, upper respiratory tract, skin, central nervous system (CNS).

Other Toxic Effects on Humans:
Hazardous in case of skin contact (irritant), of inhalation. Slightly hazardous in case of skin contact (permeator), of ingestion.

Special Remarks on Toxicity to Animals:
Lowest Publishe Lethal Dose/Conc: LDL [Rabbit] - Route: Oral; Dose: 5000 mg/kg LDL [Dog] - Route: Oral; Dose: 4000 mg/kg LDL [Cat] - Route: Oral; Dose: 4000 mg/kg

Special Remarks on Chronic Effects on Humans:
May cause adverse reproductive effects and birth defects(teratogenic). May affect genetic material (mutagenic). May cause cancer.

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects: Skin: Causes skin irritation with possible dermal blistering or burns. Symtoms may include redness, itching, pain, and possible dermal blistering or burns. It may be absorbed through the skin with possible systemic effects. A single prolonged skin exposure is not likely to result in the material being absorbed in harmful amounts. Eyes: Contact causes transient eye irritation, lacrimation. Vapors cause eye/conjunctival irritation. Symptoms may include redness and pain. Inhalation: The main route to occupational exposure is by inhalation since it is readily absorbed through the lungs. It causes respiratory tract irritation, . It can affect behavior/central nervous system (CNS depressant and anesthesia ranging from slight inebriation to death, vertigo, somnolence, anxiety, headache, excitement, hallucinations, muscle incoordination, dizziness, lightheadness, disorentiation, seizures, enotional instability, stupor, coma). It may cause pulmonary edema Ingestion: It can cause nausea, vomiting, anorexia, diarrhea, bloody stool. It may affect the liver, urinary system (proteinuria, hematuria, renal failure, renal tubular disorder), heart (arrhythmias). It may affect behavior/central nervous system with symptoms similar to that of inhalation. Chronic Potential Health Effects: Skin: Prolonged or repeated skin contact may result in excessive drying of the skin, and irritation. Ingestion/Inhalation: Chronic exposure can affect the liver(hepatitis,fatty liver degeneration), kidneys, spleen, and heart (irregular heartbeat/arrhythmias, cardiomyopathy, abnormal EEG), brain, behavior/ central nervous system/peripheral nervous system (impaired memory, numbness of extremeties, peripheral neuropathy and other

Section 12: Ecological Information

Ecotoxicity:
Ecotoxicity in water (LC50): 18.4 mg/l 96 hours [Fish (Fatthead Minnow)]. 18 mg/l 48 hours [Daphnia (daphnia)]. 5 mg/l 96 hours [Fish (Rainbow Trout)]. 13 mg/l 96 hours [Fish (Bluegill sunfish)].

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The product itself and its products of degradation are not toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: CLASS 6.1: Poisonous material.

Identification: : Tetrachloroethylene UNNA: 1897 PG: III

Special Provisions for Transport: Marine Pollutant

Section 15: Other Regulatory Information

Federal and State Regulations:
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Tetrachloroethylene California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Tetrachloroethylene Connecticut hazardous material survey.: Tetrachloroethylene Illinois toxic substances disclosure to employee act: Tetrachloroethylene Illinois chemical safety act: Tetrachloroethylene New York release reporting list: Tetrachloroethylene Rhode Island RTK hazardous substances: Tetrachloroethylene Pennsylvania RTK: Tetrachloroethylene Minnesota: Tetrachloroethylene Michigan critical material: Tetrachloroethylene Massachusetts RTK: Tetrachloroethylene Massachusetts spill list: Tetrachloroethylene New Jersey: Tetrachloroethylene New Jersey spill list: Tetrachloroethylene Louisiana spill reporting: Tetrachloroethylene California Director's List of Hazardous Substances: Tetrachloroethylene TSCA 8(b) inventory: Tetrachloroethylene TSCA 8(d) H and S data reporting: Tetrachloroethylene: Effective date: 6/1/87; Sunset date: 6/1/97 SARA 313 toxic chemical notification and release reporting: Tetrachloroethylene CERCLA: Hazardous substances.: Tetrachloroethylene: 100 lbs. (45.36 kg)

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):
CLASS D-1B: Material causing immediate and serious toxic effects (TOXIC). CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):
R40- Possible risks of irreversible effects. R51/53- Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment. S23- Do not breathe gas/fumes/vapour/spray S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. S37- Wear suitable gloves. S61- Avoid release to the environment. Refer to special instructions/Safety data sheets.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 0

Reactivity: 0

Personal Protection: g

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 0

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Safety glasses.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

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Last Updated: 06/09/2012 12:00 PM

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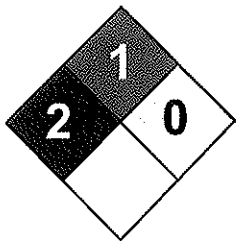

Health	2
Fire	1
Reactivity	0
Personal Protection	H

Material Safety Data Sheet
Trichloroethylene MSDS

Section 1: Chemical Product and Company Identification

Product Name: Trichloroethylene

Catalog Codes: SLT3310, SLT2590

CAS#: 79-01-6

RTECS: KX4560000

TSCA: TSCA 8(b) inventory: Trichloroethylene

CI#: Not available.

Synonym:

Chemical Formula: C2HCl3

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call: 1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Trichloroethylene	79-01-6	100

Toxicological Data on Ingredients: Trichloroethylene: ORAL (LD50): Acute: 5650 mg/kg [Rat]. 2402 mg/kg [Mouse]. DERMAL (LD50): Acute: 20001 mg/kg [Rabbit].

Section 3: Hazards Identification

Potential Acute Health Effects: Hazardous in case of skin contact (irritant, permeator), of eye contact (irritant), of ingestion, of inhalation.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Classified + (PROVEN) by OSHA. Classified A5 (Not suspected for human.) by ACGIH. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance is toxic to kidneys, the nervous system, liver, heart, upper respiratory tract. Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Cold water may be used. Do not use an eye ointment. Seek medical attention.

Skin Contact:
After contact with skin, wash immediately with plenty of water. Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Cover the irritated skin with an emollient. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek medical attention.

Inhalation: Allow the victim to rest in a well ventilated area. Seek immediate medical attention.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion:
Do not induce vomiting. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: May be combustible at high temperature.

Auto-Ignition Temperature: 420°C (788°F)

Flash Points: Not available.

Flammable Limits: LOWER: 8% UPPER: 10.5%

Products of Combustion: These products are carbon oxides (CO, CO2), halogenated compounds.

Fire Hazards in Presence of Various Substances: Not available.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:
SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.

Large Spill:
Absorb with an inert material and put the spilled material in an appropriate waste disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep locked up Keep away from heat. Keep away from sources of ignition. Empty containers pose a fire risk, evaporate the residue under a fume hood. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapour/

spray. Wear suitable protective clothing In case of insufficient ventilation, wear suitable respiratory equipment If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes

Storage:
Keep container dry. Keep in a cool place. Ground all equipment containing material. Carcinogenic, teratogenic or mutagenic materials should be stored in a separate locked safety storage cabinet or room.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:
Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 50 STEL: 200 (ppm) from ACGIH (TLV) TWA: 269 STEL: 1070 (mg/m3) from ACGIH Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Not available.

Taste: Not available.

Molecular Weight: 131.39 g/mole

Color: Clear Colorless.

pH (1% soln/water): Not available.

Boiling Point: 86.7°C (188.1°F)

Melting Point: -87.1°C (-124.8°F)

Critical Temperature: Not available.

Specific Gravity: 1.4649 (Water = 1)

Vapor Pressure: 58 mm of Hg (@ 20°C)

Vapor Density: 4.53 (Air = 1)

Volatility: Not available.

Odor Threshold: 20 ppm

Water/Oil Dist. Coeff.: The product is equally soluble in oil and water; log(oil/water) = 0

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, methanol, diethyl ether, acetone.

Solubility:
Easily soluble in methanol, diethyl ether, acetone. Very slightly soluble in cold water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Not available.

Corrosivity:
Extremely corrosive in presence of aluminum. Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: No.

Section 11: Toxicological Information

Routes of Entry: Dermal contact. Eye contact. Inhalation. Ingestion.

Toxicity to Animals:
Acute oral toxicity (LD50): 2402 mg/kg [Mouse]. Acute dermal toxicity (LD50): 20001 mg/kg [Rabbit].

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: Classified + (PROVEN) by OSHA. Classified A5 (Not suspected for human.) by ACGIH. The substance is toxic to kidneys, the nervous system, liver, heart, upper respiratory tract.

Other Toxic Effects on Humans: Hazardous in case of skin contact (irritant, permeator), of ingestion, of inhalation.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Passes through the placental barrier in human. Detected in maternal milk in human.

Special Remarks on other Toxic Effects on Humans: Not available.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are more toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: CLASS 6.1: Poisonous material.

Identification: : Trichloroethylene : UN1710 PG: III

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Trichloroethylene California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Trichloroethylene Pennsylvania RTK: Trichloroethylene Florida: Trichloroethylene Minnesota: Trichloroethylene Massachusetts RTK: Trichloroethylene New Jersey: Trichloroethylene TSCA 8(b) inventory: Trichloroethylene CERCLA: Hazardous substances.: Trichloroethylene

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:

WHMIS (Canada):
CLASS D-1B: Material causing immediate and serious toxic effects (TOXIC). CLASS D-2B: Material causing other toxic effects (TOXIC).

DSCL (EEC):
R36/38- Irritating to eyes and skin. R45- May cause cancer.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 1

Reactivity: 0

Personal Protection: h

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 1

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Splash goggles.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

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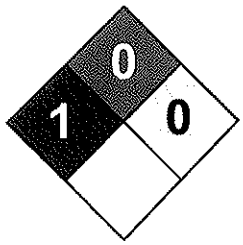

Health	1
Fire	0
Reactivity	0
Personal Protection	E

Material Safety Data Sheet
Lead MSDS

Section 1: Chemical Product and Company Identification

Product Name: Lead

Catalog Codes: SLL1291, SLL1669, SLL1081, SLL1459, SLL1834

CAS#: 7439-92-1

RTECS: OF7525000

TSCA: TSCA 8(b) inventory: Lead

CI#: Not available.

Synonym: Lead Metal, granular; Lead Metal, foil; Lead Metal, sheet; Lead Metal, shot

Chemical Name: Lead

Chemical Formula: Pb

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call: 1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Lead	7439-92-1	100

Toxicological Data on Ingredients: Lead LD50: Not available. LC50: Not available.

Section 3: Hazards Identification

Potential Acute Health Effects: Slightly hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation.

Potential Chronic Health Effects:
Slightly hazardous in case of skin contact (permeator). CARCINOGENIC EFFECTS: Classified A3 (Proven for animal.) by ACGIH, 2B (Possible for human.) by IARC. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to blood, kidneys, central nervous system (CNS). Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation occurs.

Skin Contact: Wash with soap and water. Cover the irritated skin with an emollient. Get medical attention if irritation develops.

Serious Skin Contact: Not available.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation: Not available.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: May be combustible at high temperature.

Auto-Ignition Temperature: Not available.

Flash Points: Not available.

Flammable Limits: Not available.

Products of Combustion: Some metallic oxides.

Fire Hazards in Presence of Various Substances: Non-flammable in presence of open flames and sparks, of shocks, of heat.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:
SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

Special Remarks on Fire Hazards: When heated to decomposition it emits highly toxic fumes of lead.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill:
Use appropriate tools to put the spilled solid in a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

Large Spill:
Use a shovel to put the material into a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep locked up.. Keep away from heat. Keep away from sources of ignition. Empty containers pose a fire risk, evaporate the residue under a fume hood. Ground all equipment containing material. Do not ingest. Do not breathe dust. Wear suitable

protective clothing. If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection: Safety glasses. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 0.05 (mg/m3) from ACGIH (TLV) [United States] TWA: 0.05 (mg/m3) from OSHA (PEL) [United States] TWA: 0.03 (mg/m3) from NIOSH [United States] TWA: 0.05 (mg/m3) [Canada]Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Metal solid.)

Odor: Not available.

Taste: Not available.

Molecular Weight: 207.21 g/mole

Color: Bluish-white. Silvery. Gray

pH (1% soln/water): Not applicable.

Boiling Point: 1740°C (3164°F)

Melting Point: 327.43°C (621.4°F)

Critical Temperature: Not available.

Specific Gravity: 11.3 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility: Insoluble in cold water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Incompatible materials, excess heat

Incompatibility with various substances: Reactive with oxidizing agents.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:
Can react vigorously with oxidizing materials. Incompatible with sodium carbide, chlorine trifluoride, trioxane + hydrogen peroxide, ammonium nitrate, sodium azide, disodium acetylide, sodium acetylide, hot concentrated nitric acid, hot concentrated hydrochloric acid, hot concentrated sulfuric acid, zirconium.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Inhalation. Ingestion.

Toxicity to Animals:
LD50: Not available. LC50: Not available.

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: Classified A3 (Proven for animal.) by ACGIH, 2B (Possible for human.) by IARC. May cause damage to the following organs: blood, kidneys, central nervous system (CNS).

Other Toxic Effects on Humans: Slightly hazardous in case of skin contact (irritant), of ingestion, of inhalation.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

Special Remarks on other Toxic Effects on Humans:
Acute Potential: Skin: Lead metal granules or dust: May cause skin irritation by mechanical action. Lead metal foil, shot or sheets: Not likely to cause skin irritation Eyes: Lead metal granules or dust: Can irritate eyes by mechanical action. Lead metal foil, shot or sheets: No hazard. Will not cause eye irritation. Inhalation: In an industrial setting, exposure to lead mainly occurs from inhalation of dust or fumes. Lead dust or fumes: Can irritate the upper respiratory tract (nose, throat) as well as the bronchi and lungsby mechanical action. Lead dust can be absorbed through the respiratory system. However, inhaled lead does not accumulate in the lungs. All of an inhaled dose is eventually abssorbed or transferred to the gastrointestinal tract. Inhalation effects of exposure to fumes or dust of inorganic lead may not develop quickly. Symptoms may include metallic taste, chest pain, decreased physical fitness, fatigue, sleep disturbance, headache, irritability, reduces memory, mood and personality changes, aching bones and muscles, constipation, abdominal pains, decreasing appetite. Inhalation of large amounts may lead to ataxia, deliriuim, convulsions/seizures, coma, and death. Lead metal foil, shot, or sheets: Not an inhalation hazard unless metal is heated. If metal is heated, fumes will be released. Inhalation of these fumes may cause "fume metal fever", which is characterized by flu-like symptoms. Symptoms may include metallic taste, fever, nausea, vomiting, chills, cough, weakness, chest pain, generalized muscle pain/aches, and increased white blood cell count. Ingestion: Lead metal granules or dust: The symptoms of lead poisoning include abdominal pain or cramps (lead cholic), spasms, nausea, vomiting, headache, muscle weakness, hallucinations, distorted perceptions, "lead line" on the gums, metallic taste, loss of appetite, insomnia, dizziness and other symptoms similar to that of inhalation. Acute poisoning may result in high lead levels in the blood and urine, shock, coma and death in extreme cases. Lead metal foil, shot or sheets: Not an ingestion hazard for usual industrial handling.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: Not a DOT controlled material (United States).

Identification: Not applicable.

Special Provisions for Transport: Not applicable.

Section 15: Other Regulatory Information

Federal and State Regulations:
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Lead California prop. 65: This product contains the following ingredients for which the State of California has found to cause reproductive harm (female) which would require a warning under the statute: Lead California prop. 65: This product contains the following ingredients for which the State of California has found to cause reproductive harm (male) which would require a warning under the statute: Lead California prop. 65 (no significant risk level): Lead: 0.0005 mg/day (value) California prop. 65: This product contains the following ingredients for which the State of California has found to cause birth defects which would require a warning under the statute: Lead California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Lead Connecticut hazardous material survey.: Lead Illinois toxic substances disclosure to employee act: Lead Illinois chemical safety act: Lead New York release reporting list: Lead Rhode Island RTK hazardous substances: Lead Pennsylvania RTK: Lead

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada): CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):
R20/22- Harmful by inhalation and if swallowed. R33- Danger of cumulative effects. R61- May cause harm to the unborn child. R62- Possible risk of impaired fertility. S36/37- Wear suitable protective clothing and gloves. S44- If you feel unwell, seek medical advice (show the label when possible). S53- Avoid exposure - obtain special instructions before use.

HMIS (U.S.A.):

Health Hazard: 1

Fire Hazard: 0

Reactivity: 0

Personal Protection: E

National Fire Protection Association (U.S.A.):

Health: 1

Flammability: 0

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Safety glasses.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/10/2005 08:21 PM

Last Updated: 06/09/2012 12:00 PM

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Material Safety Data Sheet Collection
Genium group inc.
1171 RiverFront Center, Amsterdam, NY 12010
(518) 842-4111

Issue Date: 2004-12

Section 1 - Chemical Product and Company Identification 54/59

Material Name: Acetone **CAS Number:** 67-64-1
Chemical Formula: C_3H_6O
Structural Chemical Formula: CH_3COCH_3
EINECS Number: 200-662-2
ACX Number: X1001253-6
Synonyms: ACETON; ACETONE; CHEVRON ACETONE; DIMETHYL KETONE; DIMETHYLFORMALDEHYDE; DIMETHYLKETAL; EPA PESTICIDE CHEMICAL CODE 004101; KETONE PROPANE; KETONE,DIMETHYL; BETA-KETOPROPANE; METHYL KETONE; 2-PROPANONE; PROPANONE; PYROACETIC ACID; PYROACETIC ETHER
General Use: Solvent for fats, oils, waxes, resins, rubber, plastics, lacquers.
Used in manufacture of methyl isobutyl ketone, mesityl oxide, acetic acid, diacetone alcohol, isoprene. Used in solvent extraction processes.
Solvent in the manufacture of explosives and rayon. Component of adhesives, glues, cleaning solvents, lacquer thinners, nail polish, paint removers.
Storing acetylene gas (takes up about 24 times its volume of the gas).
Purifying paraffin and biomedical hardening and dehydrating tissues.
Minor food additive, permitted in USA.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
acetone	67-64-1	95-99.5

OSHA PEL
TWA: 1000 ppm; 2400 mg/m^3.

OSHA PEL Vacated 1989 Limits
TWA: 750 ppm; 1800 mg/m^3;
STEL: 1000 ppm; 2400 mg/m^3.

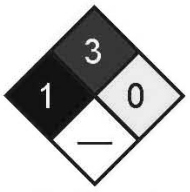
ACGIH TLV
TWA: 500 ppm; STEL: 750 ppm.

NIOSH REL
TWA: 250 ppm, 590 mg/m^3.

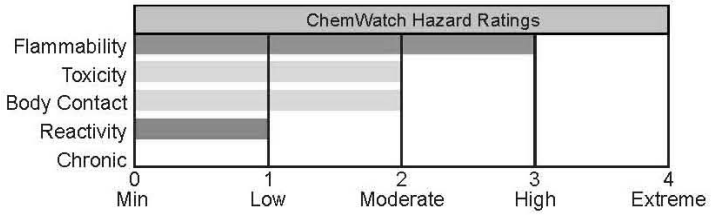
IDLH Level
2500 ppm (10% LEL).

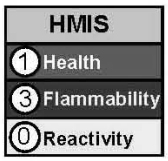
DFG (Germany) MAK
TWA: 500 ppm; PEAK: 1000 ppm.

Section 3 - Hazards Identification



Fire Diamond





ANSI Signal Word
Danger!


Flammable

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Colorless, highly volatile liquid; sweet odor. Irritating. Other Acute Effects: muscle weakness, mental confusion, coma (high concentrations). Ingestion: GI irritation, kidney/liver damage, metabolic changes, coma. Chronic Effects: dermatitis. Highly flammable.

Potential Health Effects

Target Organs: respiratory system, central nervous system (CNS), skin
Primary Entry Routes: inhalation, skin contact, eye contact, ingestion

Acute Effects

Inhalation: The vapor is discomforting to the upper respiratory tract.
Inhalation hazard is increased at higher temperatures.
Exposure to ketone vapors may produce nose, throat and mucous membrane irritation. High concentrations of vapor may produce central nervous system depression characterized by headache, vertigo, loss of coordination, narcosis and cardiorespiratory failure. Some ketones produce neurological disorders (polyneuropathy) characterized by bilateral symmetrical paresthesia and muscle weakness primarily in the legs and arms.
Symptoms of exposure may include restlessness, headache, vomiting, stupor, low blood pressure and rapid and irregular pulse, eye and throat irritation, weakness of the legs, dizziness and lightheadedness.
Inhalation of high concentrations produces dryness of the mouth and throat, dizziness, nausea, incoordinated movements, loss of coordinated speech, drowsiness, and in extreme cases, coma.
Inhalation of acetone vapors over long periods causes irritation of the respiratory tract, coughing, headache. Acetone concentrations of 52200 ppm for 1 hour produced narcosis in rats and fatalities at 126600 ppm.

Eye: The liquid may produce eye discomfort and is capable of causing temporary impairment of vision and/or transient eye inflammation, ulceration.
The vapor is discomforting to the eyes.
The material may produce severe irritation to the eye causing pronounced inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.

Skin: The liquid is discomforting to the skin if exposure is prolonged and may cause drying of the skin, which may lead to dermatitis.
Toxic effects may result from skin absorption.
Open cuts, abraded or irritated skin should not be exposed to this material.
The material may accentuate any pre-existing skin condition.
The material may cause skin irritation after prolonged or repeated exposure and may produce a contact dermatitis (nonallergic). This form of dermatitis is often characterized by skin redness (erythema) and swelling (edema) which may progress to vesiculation, scaling and thickening of the epidermis. Histologically there may be intercellular edema of the spongy layer (spongiosis) and intracellular edema of the epidermis.

Ingestion: Considered an unlikely route of entry in commercial/industrial environments.
The liquid is highly discomforting and mildly toxic if swallowed but may be harmful if swallowed in quantity.
Small amounts or low dose rates are regarded as practically non-harmful.

Carcinogenicity: NTP - Not listed; IARC - Not listed; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Class D, Not classifiable as to human carcinogenicity; MAK - Not listed.

Chronic Effects: Prolonged or continuous skin contact with the liquid may cause defatting with drying, cracking, irritation and dermatitis following.
Workers exposed to 700 ppm acetone for 3 hours/day for 7-15 years showed inflammation of the respiratory tract, stomach and duodenum, attacks of giddiness and loss of strength. Exposure to acetone may enhance liver toxicity of chlorinated solvents.

Section 4 - First Aid Measures

Inhalation: Remove to fresh air.
Lay patient down. Keep warm and rested.
If available, administer medical oxygen by trained personnel.
If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital or doctor, without delay.

Eye Contact: Immediately hold the eyes open and flush with fresh running water.
Ensure irrigation under the eyelids by occasionally lifting upper and lower lids. If pain persists or recurs seek medical attention.
Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Skin Contact: Immediately remove all contaminated clothing, including footwear (after rinsing with water).
Wash affected areas thoroughly with water (and soap if available).
Seek medical attention in event of irritation.

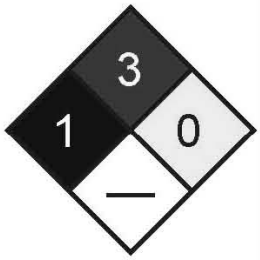
Ingestion: Rinse mouth out with plenty of water.
Contact a Poison Control Center.
Do NOT induce vomiting. Give a glass of water.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: For acute or short-term repeated exposures to acetone:
1.Symptoms of acetone exposure approximate ethanol intoxication.
2.About 20% is expired by the lungs and the rest is metabolized.
Alveolar air half-life is about 4 hours following two hour inhalation at levels near the Exposure Standard; in overdose, saturable metabolism and limited clearance, prolong the elimination half-life to 25-30 hours.
3.There are no know antidotes and treatment should involve the usual methods of decontamination followed by supportive care.

Section 5 - Fire-Fighting Measures

Flash Point: -20 °C
Autoignition Temperature: 465 °C
LEL: 2.15% v/v
UEL: 13% v/v
Extinguishing Media: Water spray or fog; alcohol stable foam.
Dry chemical powder.
Bromochlorodifluoromethane (BCF) (where regulations permit).
Carbon dioxide.
General Fire Hazards/Hazardous Combustion Products: Liquid and vapor are highly flammable.
Severe fire hazard when exposed to heat, flame and/or oxidizers.
Vapor forms an explosive mixture with air.
Severe explosion hazard, in the form of vapor, when exposed to flame or spark. Vapor may travel a considerable distance to source of ignition.
Heating may cause expansion/decomposition with violent rupture of containers.
On combustion, may emit toxic fumes of carbon monoxide (CO). Other combustion products include carbon dioxide (CO_2).



Fire Diamond

Fire Incompatibility: Avoid contamination with oxidizing agents i.e. nitrates, oxidizing acids, chlorine bleaches, pool chlorine etc. as ignition may result.
PLEASE NOTE: 10% of acetone in water has a flash point below 20 deg. C.
Fire-Fighting Instructions: Contact fire department and tell them location and nature of hazard.
May be violently or explosively reactive. Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation.
Fight fire from a safe distance, with adequate cover.
If safe, switch off electrical equipment until vapor fire hazard removed.
Use water delivered as a fine spray to control the fire and cool adjacent area. Avoid spraying water onto liquid pools.
Do not approach containers suspected to be hot.
Cool fire-exposed containers with water spray from a protective location.
If safe to do so, remove containers from path of fire.

Section 6 - Accidental Release Measures

Small Spills: Remove all ignition sources. Clean up all spills immediately.
Avoid breathing vapors and contact with skin and eyes.
Control personal contact by using protective equipment.
Contain and absorb small quantities with vermiculite or other absorbent material. Wipe up. Collect residues in a flammable waste container.
Large Spills: Clear area of personnel and move upwind.
Contact fire department and tell them location and nature of hazard.
Avoid breathing vapors and contact with skin and eyes.
May be violently or explosively reactive. Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation.
Shut off all possible sources of ignition and increase ventilation.
Water spray or fog may be used to disperse vapor.
Stop leak if safe to do so. Contain spill with sand, earth or vermiculite.
Collect residues and place in flammable waste container.
Any electric cleaning equipment must be explosion proof.
Wash spill area with large quantities of water.
If contamination of drains or waterways occurs, advise emergency services.
After clean-up operations, decontaminate and launder all protective clothing and equipment before storing and reusing.
Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Avoid all personal contact, including inhalation.
Wear protective clothing when risk of exposure occurs.
Use in a well-ventilated area. Prevent concentration in hollows and sumps.
DO NOT enter confined spaces until atmosphere has been checked.
Avoid smoking, bare lights, heat or ignition sources.
When handling, DO NOT eat, drink or smoke.

Vapor may ignite on pumping or pouring due to static electricity.
DO NOT use plastic buckets. Ground and secure metal containers when dispensing or pouring product. Use spark-free tools when handling.
Avoid contact with incompatible materials.
Keep containers securely sealed. Avoid physical damage to containers.
Always wash hands with soap and water after handling.
Work clothes should be laundered separately.
Use good occupational work practices. Observe manufacturer's storing and handling recommendations. Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions.

Recommended Storage Methods: Metal can; metal drum. Packing as recommended by manufacturer.
Check all containers are clearly labeled and free from leaks.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: CARE: Use of a quantity of this material in confined space or poorly ventilated area, where rapid build-up of concentrated atmosphere may occur, could require increased ventilation and/or protective gear. Use in a well-ventilated area. Local exhaust ventilation may be required for safe working, i. e. , to keep exposures below required standards; otherwise, PPE is required.
None required when handling small quantities. OTHERWISE: If inhalation risk of overexposure exists, wear NIOSH-approved organic-vapor respirator.

Personal Protective Clothing/Equipment:

Eyes: Safety glasses with side shields; or as required, chemical goggles.
Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.

Hands/Feet: Barrier cream with polyethylene gloves or Butyl rubber gloves or Neoprene rubber gloves.
Safety footwear.

Respiratory Protection:
Exposure Range >1000 to <2500 ppm: Supplied Air, Constant Flow/Pressure Demand, Full Face
Exposure Range 2500 to unlimited ppm: Self-contained Breathing Apparatus, Pressure Demand, Full Face
Note: use ov (black) cartridge for nuisance(<1000)

Other: Overalls. Ensure that there is ready access to eye wash unit and Ensure there is ready access to an emergency shower.

Glove Selection Index:

BUTYL/NEOPRENE	Best selection
PE/EVAL/PE	Best selection
PVDC/PE/PVDC	Best selection
BUTYL	Best selection
SARANEX-23 2-PLY	Satisfactory; may degrade after 4 hours continuous immersion
TEFLON	Satisfactory; may degrade after 4 hours continuous immersion
SARANEX-23	Poor to dangerous choice for other than short-term immersion
CPE	Poor to dangerous choice for other than short-term immersion
HYPALON	Poor to dangerous choice for other than short-term immersion
NITRILE+PVC	Poor to dangerous choice for other than short-term immersion
PVA	Poor to dangerous choice for other than short-term immersion
VITON/NEOPRENE	Poor to dangerous choice for other than short-term immersion
NEOPRENE	Poor to dangerous choice for other than short-term immersion
PVC	Poor to dangerous choice for other than short-term immersion
NATURAL+NEOPRENE	Poor to dangerous choice for other than short-term immersion
NATURAL RUBBER	Poor to dangerous choice for other than short-term immersion
NITRILE	Poor to dangerous choice for other than short-term immersion

Section 9 - Physical and Chemical Properties

Appearance/General Info: Clear, colorless, highly volatile, highly flammable liquid with characteristic sweet odor. Mixes in alcohol, ether, most hydrocarbons and oils.

Physical State: Liquid
Vapor Pressure (kPa): 24 at 20 °C
Vapor Density (Air=1): 2.0
Formula Weight: 58.08
Specific Gravity (H_2O=1, at 4 °C): 0.79 at 20 °C
Evaporation Rate: 11 (BuAc=1) VFast

pH: Not applicable
pH (1% Solution): Not applicable.
Boiling Point: 56.2 °C (133 °F) at 760 mm Hg
Freezing/Melting Point: -95.35 °C (-139.63 °F)
Volatile Component (% Vol): 100
Water Solubility: Miscible

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Product is considered stable. Hazardous polymerization will not occur.
Storage Incompatibilities: Avoid storage with oxidizers, strong acids and strong alkalis.
Reacts violently with bromoform and chloroform in the presence of alkalies or in contact with alkaline surfaces.

Section 11 - Toxicological Information

Toxicity
Oral (man) TD_{Lo}: 2857 mg/kg
Oral (rat) LD_{50}: 5800 mg/kg
Inhalation (human) TC_{Lo}: 500 ppm
Inhalation (man) TC_{Lo}: 12000 ppm/4 hr
Inhalation (man) TC_{Lo}: 10 mg/m^3/6 hr
Inhalation (rat) LC_{50}: 50100 mg/m^3/8 hr
Dermal (rabbit) LD_{50}: 20000 mg/kg

Irritation
Eye (human): 500 ppm - irritant
Eye (rabbit): 3.95 mg - SEVERE
Eye (rabbit): 20 mg/24 hr -moderate
Skin (rabbit): 395 mg (open) - mild
Skin (rabbit): 500 mg/24 hr - mild

See *RTECS* AL 3150000, for additional data.

Section 12 - Ecological Information

Environmental Fate: If released on soil, it will both volatilize and leach into the ground and probably biodegrade. If released into water, it will probably biodegrade. It will also be lost due to volatilization (estimated half-life 20 hr from a model river). Bioconcentration in aquatic organisms and adsorption to sediment should not be significant. In the atmosphere, it will be lost by photolysis and reaction with photochemically produced hydroxyl radicals. Half-life estimates from these combined processes average 22 days and are shorter in summer and longer in winter. It will also be washed out by rain.

Ecotoxicity: LD_{100} Asellus aquaticus 3 ml/l (within 3 days of exposure) /Conditions of bioassay not specified; LC_{50} Mexican axolotl 20.0 mg/l/48 hr (3-4 weeks after hatching) /Conditions of bioassay not specified; TL_m Mosquito fish 13,000 mg/l/24, 48, 96 hr /Conditions of bioassay not specified; LD_{100} Gammarus fossarum 10 ml/l (within 48 hr) /Conditions of bioassay not specified; LC_{50} Poecilia reticulata (guppy) 7,032 ppm/14 days /Conditions of bioassay not specified; LC_{50} Ring-necked pheasant oral greater than 40,000 ppm, in diet, age 10 days, (no mortality to 40,000 ppm); LC_{50} Salmo gairdneri (Rainbow trout) 5,540 mg/l/96 hr at 12 °C (95% confidence limit 4,740-6,330 mg/l), wt 1.0 g /static bioassay; LC_{50} Clawed toad 24.0 mg/l/48 hr (3-4 weeks after hatching) /Conditions of bioassay not specified; TL_m Daphnia magna 10 mg/l/24, 48 hr /Conditions of bioassay not specified

Henry's Law Constant: 3.97 x10^{-5}
BCF: negligible
Biochemical Oxygen Demand (BOD): theoretical 122%, 5 days
Octanol/Water Partition Coefficient: log K_{ow} = -0.24

Section 13 - Disposal Considerations

Disposal: Consult manufacturer for recycling options and recycle where possible.
Follow applicable federal, state, and local regulations.
Incinerate residue at an approved site.
Recycle containers where possible, or dispose of in an authorized landfill.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Shipping Name and Description: Acetone
ID: UN1090
Hazard Class: 3 - Flammable and combustible liquid
Packing Group: II - Medium Danger
Symbols:
Label Codes: 3 - Flammable Liquid
Special Provisions: IB2, T4, TP1

Packaging: **Exceptions:** 150 **Non-bulk:** 202 **Bulk:** 242
Quantity Limitations: **Passenger aircraft/rail:** 5 L **Cargo aircraft only:** 60 L
Vessel Stowage: **Location:** B **Other:**

Section 15 - Regulatory Information

EPA Regulations:

RCRA 40 CFR: Listed U002 Ignitable Waste
CERCLA 40 CFR 302.4: Listed per RCRA Section 3001 5000 lb (2268 kg)
SARA 40 CFR 372.65: Not listed
SARA EHS 40 CFR 355: Not listed
TSCA: Listed

Section 16 - Other Information

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Group, Inc. extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

Material Safety Data Sheet Collection
Genium group inc.
1171 RiverFront Center, Amsterdam, NY 12010
(518) 842-4111

Issue Date: 2005-05

Section 1 - Chemical Product and Company Identification 54/60

Material Name: n-Hexane **CAS Number:** 110-54-3
Chemical Formula: C_6H_{14}
Structural Chemical Formula: $H_3C(CH_2)_4CH_3$
EINECS Number: 203-777-6
ACX Number: X1001498-5
Synonyms: DIPROPYL; ESANI; GETTYSOLVE-B; HEKSAN; HEXANE; N-HEXANE; N-HEXANE; HEXANEN; HEXYL HYDRIDE; NORMAL HEXANE; NORMAL-HEXANE; SKELLYSOLVE-B; SKELLYSOLVE B
General Use: An incidental component of many aliphatic solvent mixes used as lacquer, paint and enamel thinners, also in ink reducers and cleaning solvents.
Also used for solvent extraction of oil seeds and in pesticide residue analysis and gas chromatography.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
n-hexane	110-54-3	> 95

OSHA PEL
TWA: 500 ppm; 1800 mg/m^3.

NIOSH REL
TWA: 50 ppm, 180 mg/m^3.

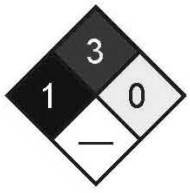
DFG (Germany) MAK
TWA: 50 ppm; PEAK: 400 ppm.

OSHA PEL Vacated 1989 Limits
TWA: 50 ppm; 180 mg/m^3.

IDLH Level
1100 ppm (10% LEL).

ACGIH TLV
TWA: 50 ppm; skin.

Section 3 - Hazards Identification



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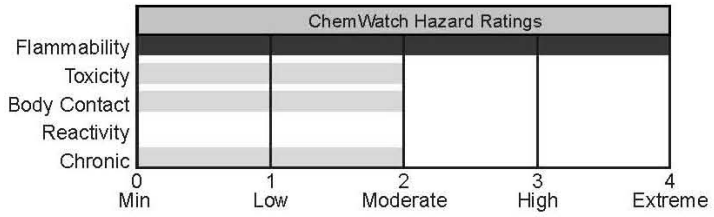
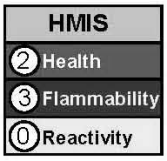




ANSI Signal Word
Danger!


Flammable

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Colorless, volatile liquid; sweet/gasoline odor. Irritating to eyes/skin/respiratory tract. Other Acute Effects: dizziness, fatigue, muscle weakness, hallucinations. Chronic Effects: muscle weakness, motor loss, sensory disturbances. Flammable.

Potential Health Effects

Target Organs: eyes, skin, respiratory system, central nervous system (CNS), peripheral nervous system
Primary Entry Routes: inhalation, skin contact/absorption, eyes, ingestion
Acute Effects
Inhalation: The vapor is discomforting and harmful to the upper respiratory tract.
Acute effects from inhalation of high concentrations of vapor are pulmonary irritation, including coughing, with nausea; central nervous system depression - characterized by headache and dizziness, increased reaction time, fatigue and loss of coordination.
If exposure to highly concentrated solvent atmosphere is prolonged this may lead to narcosis, unconsciousness, even coma and possible death.
Eye: The liquid is highly discomforting to the eyes and is capable of causing a mild, temporary redness of the conjunctiva (similar to wind-burn), temporary impairment of vision and/or other transient eye damage/ulceration.

The vapor is irritating to the eyes and may cause smarting, painand redness.
The material may be irritating to the eye, with prolonged contact causing inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.

Skin: The liquid is discomforting to the skin and is capable of causing skin reactions which may lead to dermatitis. Toxic effects may result from skin absorption.

Ingestion: The liquid is highly discomforting and harmful if swallowed.
Ingestion may result in nausea, pain, vomiting. Vomit entering the lungs by aspiration may cause potentially lethal chemical pneumonitis.
Considered an unlikely route of entry in commercial/industrial environments.

Carcinogenicity: NTP - Not listed; IARC - Not listed; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Not listed; MAK - Not listed.

Chronic Effects: Chronic inhalation or skin exposure to n-hexane may cause peripheral neuropathy, which is damage to nerve ends in extremities, e.g. fingers, with loss of sensation and characteristic thickening. Nerve damage has been documented with chronic exposures of greater than 500 ppm.
Improvement in condition does not immediately follow removal from exposure and symptoms may progress for two or three months. Recovery may take a year or more depending on severity of exposure, and may not always be complete.
Exposure to n-hexane with methyl ethyl ketone (MEK) will accelerate the appearance of damage, but MEK alone will not cause the nerve damage.
Other isomers of hexane do not cause nerve damage.

Section 4 - First Aid Measures

Inhalation: Remove to fresh air.
Lay patient down. Keep warm and rested.
If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital or doctor.

Eye Contact: Immediately hold the eyes open and flush continuously for at least 15 minutes with fresh running water. Ensure irrigation under eyelids by occasionally lifting the upper and lower lids.
Transport to hospital or doctor without delay. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Skin Contact: Immediately remove all contaminated clothing, including footwear (after rinsing with water).
Wash affected areas thoroughly with water (and soap if available).
Seek medical attention in event of irritation.

Ingestion: Contact a Poison Control Center.
Do NOT induce vomiting. Give a glass of water.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Following acute or short-term repeated exposures to n-hexane:
1.Large quantities of n-hexane are expired by the lungs after vapor exposure (50-60%). Humans exposed to 100 ppm demonstrate an n-hexane biological half life of 2 hours.
2. Initial attention should be directed towards evaluation and support of respiration. Cardiac dysrhythmias are a potential complication.
INGESTION:
1.Ipecac syrup should be considered for ingestion of pure hexane exceeding 2-3 mL/kg. Extreme caution must be taken to avoid aspiration since small amounts of n-hexane intratracheally, produce a severe chemical pneumonitis
BIOLOGICAL EXPOSURE INDEX - BEI
These represent the determinants observed in specimens collected from a healthy worker exposed at the Exposure Standard (ES or TLV):

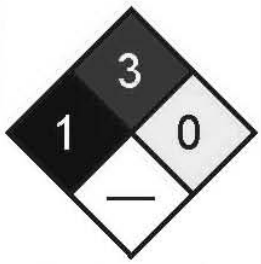
Determinant	Index	Sampling Time	Comments
2,5-hexanedione in urine	5 mg/gm creatinine	End of shift	NS
n-Hexane in end-exhaled air			SQ

NS: Non-specific determinant; Metabolite observed following exposure to other materials.
SQ: Semi-quantitative determinant; Interpretation may be ambiguous - should be used as a screening test or confirmatory test.

Section 5 - Fire-Fighting Measures

Flash Point: -22 °C
Autoignition Temperature: 225 °C
LEL: 1.1% v/v
UEL: 7.5% v/v
Extinguishing Media: Dry chemical powder. Foam.
Carbon dioxide.
General Fire Hazards/Hazardous Combustion Products: Liquid and vapor are highly flammable.
Severe fire hazard when exposed to heat, flame and/or oxidizers.
Vapor forms an explosive mixture with air.
Severe explosion hazard, in the form of vapor, when exposed to flame or spark. Vapor may travel a considerable distance to source of ignition.
Heating may cause expansion/decomposition with violent rupture of containers.
On combustion, may emit toxic fumes of carbon monoxide (CO). May emit clouds of acrid smoke.
Fire Incompatibility: Avoid reaction with oxidizing agents.
Fire-Fighting Instructions: Contact fire department and tell them location and nature of hazard.
May be violently or explosively reactive. Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation.
Fight fire from a safe distance, with adequate cover.
If safe, switch off electrical equipment until vapor fire hazard removed.
Use water delivered as a fine spray to control the fire and cool adjacent area. Avoid spraying water onto liquid pools.
Do not approach containers suspected to be hot.
Cool fire-exposed containers with water spray from a protective location.
If safe to do so, remove containers from path of fire.

See DOT ERG



Fire Diamond

Section 6 - Accidental Release Measures

Small Spills: Remove all ignition sources. Clean up all spills immediately.
Avoid breathing vapors and contact with skin and eyes.
Control personal contact by using protective equipment.
Contain and absorb small quantities with vermiculite or other absorbent material. Wipe up. Collect residues in a flammable waste container.
Large Spills: Pollutant - clear area of personnel and move upwind.
Contact fire department and tell them location and nature of hazard.
May be violently or explosively reactive. Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways.
No smoking, bare lights or ignition sources. Increase ventilation.
Stop leak if safe to do so.
Water spray or fog may be used to disperse/absorb vapor.
Contain spill with sand, earth or vermiculite.
Use only spark-free shovels and explosion proof equipment.
Collect recoverable products into labeled containers for recycling.
Absorb remaining product with sand, earth or vermiculite.
Collect solid residues and seal in labeled drums for disposal.
Wash area and prevent runoff into drains.
If contamination of drains or waterways occurs, advise emergency services.
Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

See DOT ERG

Section 7 - Handling and Storage

Handling Precautions: Avoid generating and breathing mist. Avoid all personal contact, including inhalation.
Wear protective clothing when risk of exposure occurs.
Use in a well-ventilated area. Prevent concentration in hollows and sumps.
DO NOT enter confined spaces until atmosphere has been checked.
Avoid smoking, bare lights, heat or ignition sources.
When handling, DO NOT eat, drink or smoke.
Vapor may ignite on pumping or pouring due to static electricity.
DO NOT use plastic buckets. Ground and secure metal containers when dispensing or pouring product. Use spark-free tools when handling.
Avoid contact with incompatible materials.
Keep containers securely sealed. Avoid physical damage to containers.
Always wash hands with soap and water after handling.

Work clothes should be laundered separately.
Use good occupational work practices. Observe manufacturer's storing and handling recommendations. Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions.
Avoid concurrent exposure to materials containing Methyl Ethyl Ketone MEK

Recommended Storage Methods: Metal can; metal drum. Packing as recommended by manufacturer.
Check all containers are clearly labeled and free from leaks.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Use in a well-ventilated area.
General exhaust is adequate under normal operating conditions.
Local exhaust ventilation may be required in specific circumstances.
If risk of overexposure exists, wear NIOSH-approved respirator.
Correct fit is essential to obtain adequate protection.
Provide adequate ventilation in warehouse or closed storage areas.

Personal Protective Clothing/Equipment:

Eyes: Safety glasses with side shields; or as required, chemical goggles.
Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.

Hands/Feet: Polyethylene gloves. Wear chemical protective gloves, eg. PVC.
Wear safety footwear.
Do NOT use this product to clean the skin.

Respiratory Protection:
Exposure Range >500 to <1100 ppm: Supplied Air, Constant Flow/Pressure Demand, Half Mask
Exposure Range 1100 to unlimited ppm: Self-contained Breathing Apparatus, Pressure Demand, Full Face
Note: poor warning properties

Other: Overalls. Eyewash unit. Barrier cream. Skin cleansing cream.

Glove Selection Index:

PE/EVAL/PE	Best selection
PVA	Best selection
SARANEX-23 2-PLY	Best selection
VITON	Best selection
VITON/CHLOROBUTYL	Best selection
TEFLON	Satisfactory; may degrade after 4 hours continuous immersion
NITRILE	Satisfactory; may degrade after 4 hours continuous immersion
NEOPRENE	Poor to dangerous choice for other than short-term immersion
NEOPRENE/NATURAL	Poor to dangerous choice for other than short-term immersion
NITRILE+PVC	Poor to dangerous choice for other than short-term immersion
PVC	Poor to dangerous choice for other than short-term immersion
BUTYL	Poor to dangerous choice for other than short-term immersion

Section 9 - Physical and Chemical Properties

Appearance/General Info: Clear highly flammable liquid with typical paraffinic odor; floats on water. Mixes with most other organic solvents, chloroform, ether, alcohol. A very volatile liquid, it readily forms explosive vapor /air mixes.

Physical State: Liquid
Vapor Pressure (kPa): 13.33
Vapor Density (Air=1): 2.97
Formula Weight: 86.17
Specific Gravity (H_2O=1, at 4 °C): 0.6603 at 20 °C
pH: Not applicable
pH (1% Solution): Not applicable
Boiling Point: 68.89 °C (156 °F)
Freezing/Melting Point: -100 °C (-148 °F) to -95 °C (-139 °F)
Volatile Component (% Vol): 100
Water Solubility: 0.002% by weight

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Presence of heat source and ignition source. Hazardous polymerization will not occur.

Storage Incompatibilities: Avoid storage with oxidizers.

Section 11 - Toxicological Information

Toxicity
Oral (rat) LD_{50}: 28710 mg/kg
Inhalation (human) TC_{Lo}: 190 ppm/8W
Inhalation (rat) LD_{50}: 48000 ppm/4h

Irritation
Eye (rabbit): 10 mg - mild

See *RTECS* MN9275000, for additional data.

Section 12 - Ecological Information

Environmental Fate: Photolysis, hydrolysis or bioconcentration are not expected to be an important environmental fate processes. Biodegradation may occur in soil and water; however, volatilization and adsorption are expected to be far more important fate processes. A K_{oc} range of 1250 to 4100 indicates a low to slight mobility class in soil. In aquatic systems it may partition from the water column to organic matter contained in sediments and suspended materials. A Henry's Law constant of 1.81 atm-cu m/mole at 25 °C suggests rapid volatilization from environmental waters. The volatilization half-lives from a model river and a model pond, the latter considers the effect of adsorption, have been estimated to be 2.7 hr and 6.8 days, respectively. It is expected to exist entirely in the vapor-phase in ambient air. Reactions with photochemically produced hydroxyl radicals in the atmosphere have been shown to be important (average estimated half-life of 2.9 days). Data also suggests that nighttime reactions with nitrate radicals may contribute to atmospheric transformation, especially in urban environments.
Ecotoxicity: No data found.
Henry's Law Constant: calculated at 1.81
BCF: estimated at 2.24 to 2.89
Biochemical Oxygen Demand (BOD): theoretical 0%, 7 days
Octanol/Water Partition Coefficient: log K_{ow} = 4.11
Soil Sorption Partition Coefficient: K_{oc} = estimated at 1250 to 4100

Section 13 - Disposal Considerations

Disposal: Consult manufacturer for recycling options and recycle where possible.
Follow applicable federal, state, and local regulations.
Incinerate residue at an approved site.
Recycle containers where possible, or dispose of in an authorized landfill.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Shipping Name and Description: Hexanes
ID: UN1208
Hazard Class: 3 - Flammable and combustible liquid
Packing Group: II - Medium Danger
Symbols:
Label Codes: 3 - Flammable Liquid
Special Provisions: IB2, T4, TP1
Packaging: **Exceptions:** 150 **Non-bulk:** 202 **Bulk:** 242
Quantity Limitations: **Passenger aircraft/rail:** 5 L **Cargo aircraft only:** 60 L
Vessel Stowage: **Location:** E **Other:**

Section 15 - Regulatory Information

EPA Regulations:
RCRA 40 CFR: Not listed
CERCLA 40 CFR 302.4: Listed per RCRA Section 3001 5000 lb (2268 kg)
SARA 40 CFR 372.65: Listed
SARA EHS 40 CFR 355: Not listed
TSCA: Listed

Section 16 - Other Information

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Group, Inc. extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

Material Safety Data Sheet Collection
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Issue Date: 2004-07

Unleaded Petrol
AUT5000

Section 1 - Chemical Product and Company Identification 54/58

Material Name: Unleaded Petrol
CAS Number: 8006-61-9
Chemical Formula: Mixture of hydrocarbons
EINECS Number: 232-349-1
ACX Number: X1003056-5
Synonyms: AUTOMOTIVE GASOLINE, LEAD-FREE; GASOLINE; MOTOR FUEL; MOTOR SPIRITS; NATURAL GASOLINE; PETROL; UNLEADED PETROL
General Use: Lead free motor fuel for internal combustion engines, 2-stroke and 4-stroke.

Section 2 - Composition / Information on Ingredients

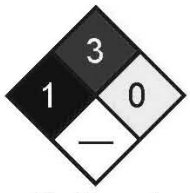
Name	CAS	%
gasoline	8006-61-9	>90
benzene	71-43-2	5 max.

OSHA PEL **NIOSH REL**

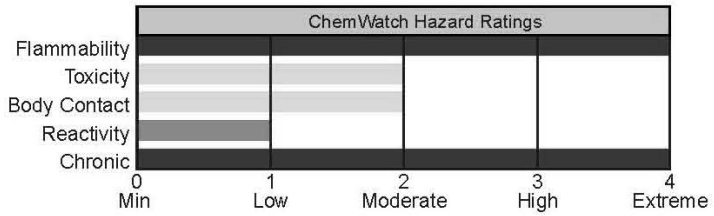
OSHA PEL Vacated 1989 Limits
TWA: 300 ppm; 900 mg/m^3;
STEL: 500 ppm; 1500 mg/m^3.

ACGIH TLV
TWA: 300 ppm, 890 mg/m^3;
STEL: 500 ppm, 1480 mg/m^3.

Section 3 - Hazards Identification



Fire Diamond



ANSI Signal Word
Danger!


Flammable

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Clear liquid; distinctive odor. Irritating to eyes/skin/respiratory tract. Also causes: dizziness, drunkenness, unconsciousness. Absorbed through skin. Chronic: dermatitis. Possible cancer hazard. Flammable. Can form explosive mixtures in air.

Potential Health Effects

Target Organs: skin, eye, respiratory system, central nervous system (CNS)
Primary Entry Routes: inhalation, ingestion, skin contact

Acute Effects

Inhalation: The vapor is discomforting to the upper respiratory tract and may be harmful if exposure is prolonged. Inhalation hazard is increased at higher temperatures. Acute effects from inhalation of high concentrations of vapor are pulmonary irritation, including coughing, with nausea; central nervous system depression - characterized by headache and dizziness, increased reaction time, fatigue and loss of coordination. If exposure to highly concentrated solvent atmosphere is prolonged this may lead to narcosis, unconsciousness, even coma and possible death. WARNING: Intentional misuse by concentrating/inhaling contents may be lethal. High inhaled concentrations of mixed hydrocarbons may produce narcosis characterized by nausea, vomiting and lightheadedness. Inhalation of aerosols may produce severe pulmonary edema, pneumonitis and pulmonary hemorrhage. Inhalation of petroleum hydrocarbons consisting substantially of low molecular weight species may produce irritation of mucous membranes, incoordination, giddiness, nausea, vertigo, confusion, headache, appetite loss, drowziness, tremors and anesthetic stupor. Massive exposures may produce central nervous system depression with sudden collapse and deep coma; fatalities have been recorded. Irritation of the brain and/or apneic anoxia may produce convulsions. Although recovery following overexposure is generally complete, cerebral micro- hemorrhage of focal post-inflammatory scarring may produce eleptiform seizures some months after the exposure. Pulmonary episodes may include chemical pneumonitis with edema and hemorrhage. The lighter hydrocarbons may produce kidney and neurotoxic effects. Liquid paraffins may produce anesthesia and depressant actions leading to weakness, dizziness, slow and shallow respiration, unconsciousness, convulsions and death. C_{5-7} paraffins may also produce polyneuropathy. Aromatic hydrocarbons accumulate in lipid-rich tissues (typically the brain, spinal cord and peripheral nerves) and may produce functional impairment manifested by nonspecific symptoms such as nausea, weakness, fatigue, vertigo; severe exposures may produce inebriation or unconsciousness. Many of the petroleum hydrocarbons are cardiac sensitizers and may cause ventricular fibrillations.

Eye: The liquid may produce eye discomfort and is capable of causing temporary impairment of vision and/or transient eye inflammation, ulceration. The vapor is discomforting to the eyes. Petroleum hydrocarbons may produce pain after direct contact with the eyes. Slight, but transient, disturbances of the corneal epithelium may also result. The aromatic fraction may produce irritation and lachrymation. The material may produce moderate eye irritation leading to inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.

Skin: The material is moderately discomforting to the skin if exposure is prolonged. The material contains a component that may be absorbed through the skin and may cause drying of the skin, which may lead to dermatitis from repeated exposures over long periods. Toxic effects may result from skin absorption. Open cuts, abraded or irritated skin should not be exposed to this material. The material may accentuate any pre-existing dermatitis condition.

Ingestion: Considered an unlikely route of entry in commercial/industrial environments. The liquid may produce gastrointestinal discomfort and may be harmful if swallowed. Ingestion may result in nausea, pain and vomiting. Vomit entering the lungs by aspiration may cause potentially lethal chemical pneumonitis. Ingestion of petroleum hydrocarbons may produce irritation of the pharynx, esophagus, stomach and small intestine with edema and mucosal ulceration. Resulting symptoms include a burning sensation in the mouth and throat. Large amounts may produce narcosis with nausea and vomiting, weakness or dizziness, slow and shallow respiration, swelling of the abdomen, unconsciousness and convulsions. Myocardial injury may produce arrhythmias, ventricular fibrillation and electrocardiographic changes. Central nervous system depression may also occur. Light aromatic hydrocarbons produce a warm, sharp, tingling sensation on contact with taste buds and may anesthetize the tongue. Aspiration into the lungs may produce coughing, gagging, and a chemical pneumonitis with pulmonary edema and hemorrhage.

Carcinogenicity: NTP - Not listed; IARC - Group 2B, Possibly carcinogenic to humans; OSHA - Not listed; NIOSH - Listed as carcinogen; ACGIH - Class A3, Animal carcinogen; EPA - Not listed; MAK - Not listed.

Chronic Effects: Chronic solvent inhalation exposures may result in nervous system impairment and liver and blood changes. Prolonged or continuous skin contact with the liquid may cause defatting with drying, cracking, irritation and dermatitis following. Chronic poisoning may occur from vapor inhalation or skin absorption. The most significant toxic effect is insidious and irreversible injury to the blood-forming tissue by benzene. Leukemia may develop. Chronic exposure may cause headache, fatigue, loss of appetite and lassitude with incipient blood effects including anemia and blood changes. Gasoline "sniffing" has caused severe nerve damage. Repeated or prolonged exposure to mixed hydrocarbons may produce narcosis with dizziness, weakness, irritability, concentration and/or memory loss, tremor in the fingers and tongue, vertigo, olfactory disorders, constriction of visual field, paresthesias of the extremities, weight loss and anemia and degenerative changes in the liver and kidney. Chronic exposure by petroleum workers to the lighter hydrocarbons has been associated with visual disturbances, damage to the central nervous system, peripheral neuropathies (including numbness and paresthesias), psychological and neurophysiological deficits, bone marrow toxicities (including hypoplasia, possibly due to benzene) and hepatic and renal involvement. Chronic dermal exposure to petroleum hydrocarbons may result in defatting which produces localized dermatoses. Surface cracking and erosion may also increase susceptibility to infection by microorganisms.

Section 4 - First Aid Measures

Inhalation: Remove to fresh air. Lay patient down. Keep warm and rested.
If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital, or doctor.

Eye Contact: Immediately hold the eyes open and wash continuously for at least 15 minutes with fresh running water. Ensure irrigation under eyelids by occasionally lifting the upper and lower lids. Transport to hospital or doctor without delay. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Skin Contact: Immediately remove all contaminated clothing, including footwear (after rinsing with water). Wash affected areas thoroughly with water (and soap if available). Seek medical attention in event of irritation.

Ingestion: Contact a Poison Control Center. If swallowed, do NOT induce vomiting. Give a glass of water.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: For acute or short term repeated exposures to petroleum distillates or related hydrocarbons:

1. Primary threat to life from pure petroleum distillate ingestion and/or inhalation is respiratory failure.
2. Patients should be quickly evaluated for signs of respiratory distress (e.g. cyanosis, tachypnea, intercostal retraction, obtundation) and given oxygen. Patients with inadequate tidal volumes or poor arterial blood gases (pO_2 <50 mm Hg or pCO_2 >50 mm Hg) should be intubated.
3. Arrhythmias complicate some hydrocarbon ingestion and/or inhalation and electrocardiographic evidence of myocardial injury has been reported; intravenous lines and cardiac monitors should be established in obviously symptomatic patients. The lungs excrete inhaled solvents, so that hyperventilation improves clearance.
4. A chest x-ray should be taken immediately after stabilization of breathing and circulation to document aspiration and detect the presence of pneumothorax.
5. Epinephrine (adrenalin) is not recommended for treatment of bronchospasm because of potential myocardial sensitization to catecholamines.
   Inhaled cardioselective bronchodilators (e.g. Alupent, Salbutamol) are the preferred agents, with aminophylline a second choice.
6. Lavage is indicated in patients who require decontamination; ensure use of cuffed endotracheal tube in adult patients.

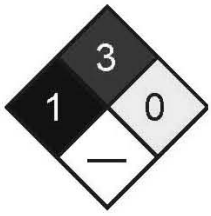
Section 5 - Fire-Fighting Measures

Flash Point: -43 °C

Autoignition Temperature: 280 °C

LEL: 1.4% v/v

UEL: 7.6% v/v



Fire Diamond

Extinguishing Media: Foam. Dry chemical powder. Bromochlorodifluoromethane (BCF) (where regulations permit). Carbon dioxide.

General Fire Hazards/Hazardous Combustion Products: Liquid and vapor are highly flammable. Severe fire hazard when exposed to heat, flame and/or oxidizers. Vapor forms an explosive mixture with air. Severe explosion hazard, in the form of vapor, when exposed to flame or spark. Vapor may travel a considerable distance to source of ignition. Heating may cause expansion/decomposition with violent rupture of containers. On combustion, may emit toxic fumes of carbon monoxide (CO).

Fire Incompatibility: Avoid contamination with oxidizing agents, i.e. nitrates, oxidizing acids, chlorine bleaches, pool chlorine etc., as ignition may result.

Fire-Fighting Instructions: Alert fire department and tell them location and nature of hazard. May be violently or explosively reactive. Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or water ways. If safe, switch off electrical equipment until vapour fire hazard removed.
Use water delivered as a fine spray to control fire and cool adjacent area. Avoid spraying water onto liquid pools. Do not approach containers suspected to be hot. Cool fire exposed containers with water spray from a protected location. If safe to do so, remove containers from path of fire.

Section 6 - Accidental Release Measures

Small Spills: Remove all ignition sources. Clean up all spills immediately. Avoid breathing vapors and contact with skin and eyes. Control personal contact by using protective equipment. Contain and absorb small quantities with vermiculite or other absorbent material. Wipe up. Collect residues in a flammable waste container.

Large Spills: Clear area of personnel and move upwind. Alert fire department and tell them location and nature of hazard. May be violently or explosively reactive. Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or water ways. No smoking, naked lights or ignition sources. Increase ventilation. Stop leak if safe to do so.
Water spray or fog may be used to disperse/absorb vapor. Contain spill with sand, earth or vermiculite. Use only spark-free shovels and explosion proof equipment. Collect recoverable product into labeled containers for recycling. Absorb remaining product with sand, earth or vermiculite. Collect solid residues and seal in labelled drums for disposal. Wash area and prevent runoff into drains.
If contamination of drains or waterways occurs, advise emergency services.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 11 - Toxicological Information

Toxicity
Oral (rat) LD_{50}: 18800 mg/kg

Irritation
Skin (rabbit): 500 mg/24h mild

Section 12 - Ecological Information

Environmental Fate: No data found.
Ecotoxicity: No data found.
Biochemical Oxygen Demand (BOD): 8%, 5 days

Section 13 - Disposal Considerations

Disposal: Consult manufacturer for recycling options and recycle where possible. Follow all applicable federal, state, and local laws. Incinerate residue at an approved site. Recycle containers where possible, or dispose of in an authorized landfil.
BEWARE: Empty solvent, paint, lacquer and flammable liquid drums present a severe explosion hazard if cut by flame torch or welded. Even when thoroughly cleaned or reconditioned, the drum seams may retain sufficient solvent to generate an explosive atmosphere in the drum.

Section 14 - Transport Information

DOT Transportation Data (49 CFR 172.101):

Shipping Name: MOTOR SPIRIT OR GASOLINE OR PETROL
Additional Shipping Information: PETROL
Hazard Class: 3.1
ID No.: 1203
Packing Group: II
Label: Flammable Liquid[3]

Section 15 - Regulatory Information

EPA Regulations:
RCRA 40 CFR: Not listed
CERCLA 40 CFR 302.4: Not listed
SARA 40 CFR 372.65: Not listed
SARA EHS 40 CFR 355: Not listed
TSCA: Listed

Section 16 - Other Information

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Group, Inc. extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

Material Safety Data Sheet Collection
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Issue Date: 2004-07

Nitric Acid
NIT1080

Section 1 - Chemical Product and Company Identification 54/58

Material Name: Nitric Acid
CAS Number: 7697-37-2
Chemical Formula: HNO_3
Structural Chemical Formula: HNO_3
EINECS Number: 231-714-2
ACX Number: X1002177-5
Synonyms: ACIDE NITRIQUE; ACIDO NITRICO; AQUA FORTIS; AZOTIC ACID; AZOTOWY KWAS; ENGRAVER'S ACID; ENGRAVERS ACID; HYDROGEN NITRATE; KYSELINA DUSICNE; NITAL; NITRIC ACID; NITRIC ACID OTHER THAN RED FUMING WITH >70% NITRIC ACID; NITRIC ACID OTHER THAN RED FUMING WITH NOT >70% NITRICACID; NITROUS FUMES; NITRYL HYDROXIDE; RED FUMING NITRIC ACID (RFNA); SALPETERSAURE; SALPETERZUUROPLOSSINGEN; WHITE FUMING NITRIC ACID (WFNA)
General Use: Manufacture of organic and inorganic nitrates and nitro compounds for fertilizers, dye intermediates and many organic chemicals.
Used for etching and cleaning metals.
Operators should be trained in procedures for safe use of this material.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
nitric acid	7697-37-2	>95

OSHA PEL
TWA: 2 ppm; 5 mg/m^3.

OSHA PEL Vacated 1989 Limits
TWA: 2 ppm; 5 mg/m^3; STEL: 4 ppm; 10 mg/m^3.

ACGIH TLV
TWA: 2 ppm; STEL: 4 ppm.

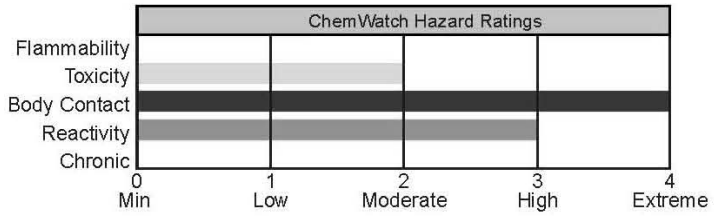
NIOSH REL
TWA: 2 ppm, 5 mg/m^3; STEL: 4 ppm, 10 mg/m^3.

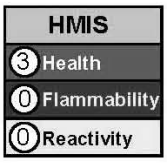
IDLH Level
25 ppm.

DFG (Germany) MAK
TWA: 2 ppm; PEAK: 2 ppm.

Section 3 - Hazards Identification

Fire Diamond





ANSI Signal Word
Danger!


Corrosive

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Clear to yellow fuming liquid; acrid, suffocating odor. Corrosive, causes severe burns to eyes/skin/respiratory tract. Also causes: heavy exposures: lung damage. Chronic: tooth erosion, bronchitis. Strong oxidizer capable of igniting combustibles.

Potential Health Effects

Target Organs: eyes, skin, respiratory system, teeth
Primary Entry Routes: inhalation, ingestion, skin contact, eye contact
Acute Effects
Inhalation: The vapor is extremely discomforting and corrosive to the upper respiratory tract and lungs and the material presents a hazard from a single acute exposure or from repeated exposures over long periods.

Inhalation hazard is increased at higher temperatures.
Reactions may occur following a single acute exposure or may only appear after repeated exposures.
Reactions may not occur on exposure but response may be delayed with symptoms only appearing many hours later.
The material may produce respiratory tract irritation which produces an inflammatory response involving the recruitment and activation of many cell types, mainly derived from the vascular system. Unlike most organs the lung can respond to a chemical insult or agent by first trying to remove or neutralize the irritant and then repairing the damage. The repair process, which initially developed to protect mammalian lungs from foreign matter and antigens, may however, cause further damage the lungs when activated by hazardous chemicals. The result is often the impairment of gas exchange, the primary function of the lungs.
Inhalation of nitric acid mist or fumes at 2 to 25 ppm over an 8 hour period may cause pulmonary irritation and symptoms of lung damage.
Only several minutes of exposure to concentrated atmosphere i.e. 200 ppm may cause severe pulmonary damage and even fatality. Death may be delayed for several days.
Exposure to nitric acid fumes (with concurrent inhalation of nitrogen dioxide and nitric oxide) may elicit prompt irritation of the upper respiratory tract leading to coughing, gagging, chest pain, dyspnea, cyanosis if concentrations are sufficiently high and duration of exposure sufficiently long, pulmonary edema.

Eye: The liquid is extremely corrosive to the eyes and contact may cause rapid tissue destruction and is capable of causing severe damage with loss of sight.
The vapor is extremely discomforting to the eyes and is capable of causing pain and severe conjunctivitis.
Corneal injury may develop, with possible permanent impairment of vision, if not promptly and adequately treated.
The material may produce moderate eye irritation leading to inflammation.
Repeated or prolonged exposure to irritants may produce conjunctivitis.
Eye contact with concentrated acid may give no pain, whilst diluted solution causes intense pain and both can cause permanent eye damage or blindness. Burns may result in shrinkage of the eyeball, symblepharon (adhesions between tarsal and bulbar conjunctivae), permanent corneal opacification, and visual impairment leading to blindness.

Skin: The liquid is extremely corrosive to the skin and contact may cause tissue destruction with severe burns.
Bare unprotected skin should not be exposed to this material.
The vapor is highly discomforting to the skin.
The material may cause skin irritation after prolonged or repeated exposure and may produce a contact dermatitis (nonallergic). This form of dermatitis is often characterized by skin redness (erythema) and swelling (edema) which may progress to vesiculation, scaling and thickening of the epidermis. Histologically there may be intercellular edema of the spongy layer (spongiosis) and intracellular edema of the epidermis.
Skin contact causes yellow discoloration of the skin, blisters and scars that may not heal. The skin may be stained bright-yellow or yellowish brown due to the formation of xanthoproteic acid. Dilute solutions may harden the epithelium without producing overt corrosion.

Ingestion: Considered an unlikely route of entry in commercial/industrial environments.
The material is extremely corrosive if swallowed and is capable of causing burns to mouth, throat, esophagus, with extreme discomfort, pain and may be fatal.
Even a small amount causes severe corrosion of the stomach, burning pain, vomiting and shock, possibly causing non-healing scarring of the gastrointestinal tract and stomach. Death may be delayed 12 hours to 14 days or to several months. Such late fatalities are attributed to a chemical lobular pneumonitis secondary to aspiration. Survivors show stricture of the gastric mucosa and subsequent pernicious anemia.

Carcinogenicity: NTP - Not listed; IARC - Not listed; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Not listed; MAK - Not listed.

Chronic Effects: Prolonged or repeated overexposure to low concentrations of vapor may cause chronic bronchitis, corrosion of teeth, even chemical pneumonitis.

Section 4 - First Aid Measures

Inhalation: Remove to fresh air.
Lay patient down. Keep warm and rested.
If available, administer medical oxygen by trained personnel.
If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital or doctor, without delay.

Eye Contact: Immediately hold the eyes open and flush continuously for at least 15 minutes with fresh running water.
Ensure irrigation under eyelids by occasionally lifting the upper and lower lids.
Transport to hospital or doctor without delay. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.
Immediately transport to hospital or doctor. DO NOT delay.

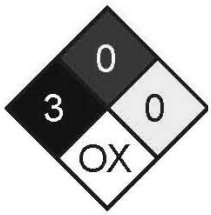
Skin Contact: Immediately flush body and clothes with large amounts of water, using safety shower if available.
Quickly remove all contaminated clothing, including footwear.
Wash affected areas with water (and soap if available) for at least 15 minutes. Transport to hospital or doctor. DO NOT delay.

Ingestion: Contact a Poison Control Center.

Do NOT induce vomiting. Give a glass of water.
Immediately transport to hospital or doctor. DO NOT delay.
After first aid, get appropriate in-plant, paramedic, or community medical support.
Note to Physicians: For acute or short-term repeated exposures to strong acids:
1.Airway problems may arise from laryngeal edema and inhalation exposure.
Treat with 100% oxygen initially.
2.Respiratory distress may require cricothyroidotomy if endotracheal intubation is contraindicated by excessive swelling.
3. Intravenous lines should be established immediately in all cases where there is evidence of circulatory compromise.
4.Strong acids produce a coagulation necrosis characterized by formation of a coagulum (eschar) as a result of the desiccating action of the acid on proteins in specific tissues.
INGESTION:
1.Immediate dilution (milk or water) within 30 minutes post-ingestion is recommended.
2.Do not attempt to neutralize the acid since exothermic reaction may extend the corrosive injury.
3.Be careful to avoid further vomiting since re-exposure of the mucosa to the acid is harmful. Limit fluids to one or two glasses in an adult.
4.Charcoal has no place in acid management.
5.Some authors suggest the use of lavage within 1 hour of ingestion.
SKIN:
1.Skin lesions require copious saline irrigation. Treat chemical burns as thermal burns with non-adherent gauze and wrapping.
2.Deep second-degree burns may benefit from topical silver sulfadiazine.
EYE:
1.Eye injuries require retraction of the eyelids to ensure thorough irrigation of the conjunctival cul-de-sacs. Irrigation should last at least 20-30 minutes. Do not use neutralizing agents or any other additives. Several liters of saline are required.
2.Cycloplegic drops (1% cyclopentolate for short-term use or 5% homatropine for longer term use), antibiotic drops, vasoconstrictive agents, or artificial tears may be indicated dependent on the severity of the injury.
3.Steroid eye drops should only be administered with the approval of a consulting ophthalmologist.

Section 5 - Fire-Fighting Measures

Flash Point: Nonflammable
Autoignition Temperature: Not applicable
LEL: Not applicable
UEL: Not applicable
Extinguishing Media: Water spray or fog; foam, dry chemical powder, or BCF (where regulations permit).
Carbon dioxide.



Fire Diamond

General Fire Hazards/Hazardous Combustion Products: Will not burn but increases intensity of fire.
Heating may cause expansion or decomposition leading to violent rupture of containers. Heat affected containers remain hazardous.
Contact with combustibles such as wood, paper, oil or finely divided metal may cause ignition, combustion or violent decomposition.
May emit irritating, poisonous or corrosive fumes.
Decomposes on heating and produces toxic fumes of nitrogen oxides (NO_x) and nitric acid.
Fire Incompatibility: Oxidizing agents as a class are not necessarily combustible themselves, but can increase the risk and intensity of fire in many other substances.
Reacts vigorously with water and alkali.
Avoid reaction with organic materials/compounds, powdered metals, reducing agents and hydrogen sulfide (H_2S) as ignition may result.
Reacts with metals producing flammable/explosive hydrogen gas.
Fire-Fighting Instructions: Contact fire department and tell them location and nature of hazard.
May be violently or explosively reactive. Wear full body protective clothing with breathing apparatus. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation.
Fight fire from a safe distance, with adequate cover.
Extinguishers should be used only by trained personnel.
Use water delivered as a fine spray to control fire and cool adjacent area.
Avoid spraying water onto liquid pools.
Do not approach containers suspected to be hot.
Cool fire-exposed containers with water spray from a protected location.
If safe to do so, remove containers from path of fire.
If fire gets out of control withdraw personnel and warn against entry.

Equipment should be thoroughly decontaminated after use.

Section 6 - Accidental Release Measures

Small Spills: Dangerous levels of nitrogen oxides may form during spills of nitric acid.
Wear fully protective PVC clothing and breathing apparatus.
Clean up all spills immediately. No smoking, bare lights, ignition sources.
Avoid all contact with any organic matter including fuel, solvents, sawdust, paper or cloth and other incompatible materials, as ignition may result.
Avoid breathing dust or vapors and all contact with skin and eyes.
Control personal contact by using protective equipment.
Contain and absorb spill with dry sand, earth, inert material or vermiculite. DO NOT use sawdust as fire may result.
Scoop up solid residues and seal in labeled drums for disposal.
Neutralize/decontaminate area.
Use soda ash or slaked lime to neutralize.
Large Spills: DO NOT touch the spill material. Restrict access to area.
Clear area of personnel and move upwind. Contact fire department and tell them location and nature of hazard.
May be violently or explosively reactive. Wear full body protective clothing with breathing apparatus. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation.
No smoking, flames or ignition sources. Increase ventilation.
Contain spill with sand, earth or other clean, inert materials.
NEVER use organic absorbents such as sawdust, paper, cloth; as fire may result. Avoid any contamination by organic matter.
Use spark-free and explosion-proof equipment.
Collect any recoverable product into labeled containers for possible recycling. DO NOT mix fresh with recovered material.
Collect residues and seal in labeled drums for disposal.
Wash area and prevent runoff into drains. Decontaminate equipment and launder all protective clothing before storage and reuse.
If contamination of drains or waterways occurs advise emergency services.
DO NOT USE WATER OR NEUTRALIZING AGENTS INDISCRIMINATELY ON LARGE SPILLS.
Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Avoid generating and breathing mist. Do not allow clothing wet with material to stay in contact with skin.
Avoid all personal contact, including inhalation.
Wear protective clothing when risk of exposure occurs.
Use in a well-ventilated area.
WARNING: To avoid violent reaction, ALWAYS add material to water and NEVER water to material.
Avoid smoking, bare lights or ignition sources.
Avoid contact with incompatible materials.
When handling, DO NOT eat, drink or smoke.
Keep containers securely sealed when not in use. Avoid physical damage to containers. Always wash hands with soap and water after handling. Work clothes should be laundered separately.
Launder contaminated clothing before reuse.
Use good occupational work practices. Observe manufacturer's storing and handling recommendations. Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions are maintained.
Recommended Storage Methods: Stainless steel drum. Check that containers are clearly labeled.
Packaging as recommended by manufacturer.
Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Use in a well-ventilated area.
Local exhaust ventilation may be required for safe working, i. e. , to keep exposures below required standards; otherwise, PPE is required.
If risk of overexposure exists, wear NIOSH-approved respirator.
Correct fit is essential to obtain adequate protection.
In confined spaces where there is inadequate ventilation, wear full-face air supplied breathing apparatus.
Personal Protective Clothing/Equipment:
Eyes: Chemical goggles. Full face shield.
DO NOT wear contact lenses. Contact lenses pose a special hazard; soft contact lenses may absorb irritants and all lenses concentrate them.

Hands/Feet: Bare unprotected skin should not be exposed to this material. Impervious, gauntlet length gloves i.e., butyl rubber gloves or Neoprene rubber gloves or wear chemical protective gloves, e.g. PVC.
Wear safety footwear or safety gumboots, e.g. Rubber.

Respiratory Protection:
Exposure Range >2 to <25 ppm: Supplied Air, Constant Flow/Pressure Demand, Half Mask
Exposure Range 25 to unlimited ppm: Self-contained Breathing Apparatus, Pressure Demand, Full Face

Other: Operators should be trained in procedures for safe use of this material.
Acid-resistant overalls or Rubber apron or PVC apron.
Ensure there is ready access to an emergency shower.
Ensure that there is ready access to eye wash unit.
Ensure that there is ready access to breathing apparatus.

Glove Selection Index:

BUTYL	Best selection
HYPALON	Best selection
NEOPRENE	Best selection
NEOPRENE/NATURAL	Best selection
PE/EVAL/PE	Best selection
SARANEX-23	Best selection
NATURAL RUBBER	Satisfactory; may degrade after 4 hours continuous immersion
NATURAL+NEOPRENE	Satisfactory; may degrade after 4 hours continuous immersion
PVC	Poor to dangerous choice for other than short-term immersion
NITRILE+PVC	Poor to dangerous choice for other than short-term immersion

Section 9 - Physical and Chemical Properties

Appearance/General Info: Clear, colorless to slightly yellow liquid. Sharp strong odor.
CAUTION: exothermic dilution hazard.
HIGHLY CORROSIVE. Corrosive to most metals. Powerful oxidizing agent.
Darkens to brownish color on aging and exposure to light.

Physical State: Liquid
Vapor Pressure (kPa): 8.26
Vapor Density (Air=1): 1.5
Formula Weight: 63.02
Specific Gravity (H_2O=1, at 4 °C): 1.3-1.42
pH: < 1
pH (1% Solution): 1
Boiling Point: 83 °C (181 °F) at 760 mm Hg
Freezing/Melting Point: -42 °C (-43.6 °F)
Volatile Component (% Vol): 100 (nominal)
Decomposition Temperature (°C): Not applicable
Water Solubility: Soluble in all proportions

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Presence of heat source and direct sunlight. Storage in unsealed containers. Hazardous polymerization will not occur.

Storage Incompatibilities: Segregate from reducing agents, finely divided combustible materials, combustible materials, sawdust, metals and powdered metals.
Avoid contamination of water, foodstuffs, feed or seed.
Segregate from alkalies, oxidizing agents and chemicals readily decomposed by acids, i.e. cyanides, sulfides, carbonates.

Section 11 - Toxicological Information

Toxicity
Oral (human) LD_{Lo}: 430 mg/kg
Inhalation (rat) LC_{50}: 2500 ppm/1 hr
Unreported (man) LD_{Lo}: 110 mg/kg

Irritation
Nil reported

See NIOSH, *RTECS* QU 5775000, for additional data.

Section 12 - Ecological Information

Environmental Fate: No data found.

Ecotoxicity: LC_{50} Starfish 100-300 mg/l/48 hr /Aerated water conditions; LC_{50} Shore crab 180 mg/l/48 hr /Static, aerated water conditions; LC_{50} Cockle 330-1000 mg/l/48 hr /Aerated water conditions

BCF: no food chain concentration potential

Biochemical Oxygen Demand (BOD): none

Section 13 - Disposal Considerations

Disposal: Recycle wherever possible. Special hazards may exist - specialist advice may be required.
Consult manufacturer for recycling options.
Follow applicable federal, state, and local regulations.
Treat and neutralize at an approved treatment plant.
Decontaminate empty containers. Observe all label safeguards until containers are cleaned and destroyed.
Puncture containers to prevent reuse and bury at an authorized landfill.

Section 14 - Transport Information

DOT Transportation Data (49 CFR 172.101):

Shipping Name: NITRIC ACID
Hazard Class: 8
ID No.: 2031
Packing Group: I
Label: Corrosive[8],Oxid.Agent

Section 15 - Regulatory Information

EPA Regulations:
RCRA 40 CFR: Not listed
CERCLA 40 CFR 302.4: Listed per CWA Section 311(b)(4) 1000 lb (453.5 kg)
SARA 40 CFR 372.65: Listed
SARA EHS 40 CFR 355: Listed
RQ: 1000 lb
TPQ: 1000 lb
TSCA: Listed

Section 16 - Other Information

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Group, Inc. extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

Material Safety Data Sheet Collection

Genium group inc.

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Issue Date: 2006-06

Hydrochloric Acid
HYD2200

Section 1 - Chemical Product and Company Identification 61

Material Name: Hydrochloric Acid **CAS Number:** 7647-01-0
Chemical Formula: ClH
Structural Chemical Formula: HCl
EINECS Number: 231-595-7
ACX Number: X1002202-3
Synonyms: 4-D BOWL SANITIZER; ACIDE CHLORHYDRIQUE; ACIDO CLORHIDRICO; ACIDO CLORIDRICO; ANHYDROUS HYDROCHLORIC ACID; ANHYDROUS HYDROGEN CHLORIDE; AQUEOUS HYDROGEN CHLORIDE; BOWL CLEANER; CHLOORWATERSTOF; CHLOROHYDRIC ACID; CHLOROWODOR; CHLORURE D'HYDROGENE; CHLORURE D'HYDROGENE ANHYDRE; CHLORURO DE HIDROGENO; CHLORWASSERSTOFF; CLORURO DE HIDROGENO ANHIDRO; EMULSION BOWL CLEANER; EPA PESTICIDE CHEMICAL CODE 045901; HYDROCHLORIC ACID; HYDROCHLORIC ACID GAS; HYDROCHLORIDE; HYDROGEN CHLORIDE; HYDROGEN CHLORIDE (HCL); HYGEIA CREME MAGIC BOWL CLEANER; MURIATIC ACID; MURIATIC ACID); NOW SOUTH SAFTI-SOL BRAND CONCENTRATED BOWL CLEANSE WITHMAGIC ACTIO; PERCLEEN BOWL AND URINAL CLEANER; SPIRITS OF SALT; VARLEY'S OCEAN BLUE SCENTED TOILET BOWL CLEANER; VARLEY POLY-PAK BOWL CREME; WHITE EMULSION BOWL CLEANER; WUEST BOWL CLEANER SUPER CONCENTRATED
General Use: Hydrogen chloride is used to produce pharmaceutical hydrochlorides; vinyl chloride from acetylene; alkyl chlorides from olefins and arsenious chloride from arsenious oxide; electronic grade for etching semiconductor crystals. Used in the chlorination of rubber; in organic reactions involving isomerization, polymerization and alkylation; as a catalyst and condensing agent; for making chlorine where economical; in the separation of cotton from wool and cotton de-linting; as flux in the babbitt type of metal alloy; etching semi-conductor crystals.
Hydrochloric acid is used for pickling and heavy duty cleaning of metal parts; rust and scale removal. The production of chlorides; neutralizing bases; a laboratory reagent. For hydrolyzing starch and proteins in preparations for food. As a catalyst and solvent in organic synthesis. As "spirits of salts" for cleaning of lime and masonry from new brickwork. As flux or flux component for soldering; manufacture of "killed spirits".

Section 2 - Composition / Information on Ingredients

Name	CAS	%
hydrogen chloride	7647-01-0	> 99.0

OSHA PEL
Ceiling: 5 ppm, 7 mg/m^3.

NIOSH REL
Ceiling: 5 ppm (7 mg/m^3).

DFG (Germany) MAK
TWA: 5 ppm; PEAK: 5 ppm.

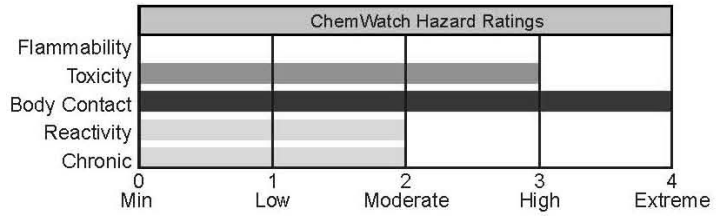
ACGIH TLV
Ceiling: 2 ppm.

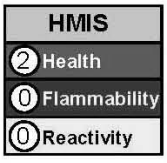
IDLH Level
50 ppm.

EU OEL
TWA: 5 ppm; STEL: 10 ppm.

Section 3 - Hazards Identification

Fire Diamond





ANSI Signal Word

Danger!


Corrosive Compressed Gas

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Colorless gas; characteristic suffocating, pungent odor. Corrosive. Stored as compressed gas which may cause frostbite. Chronic Effects: erosion of teeth.

Potential Health Effects

Target Organs: eyes, skin, respiratory system, liver (in animals)
Primary Entry Routes: inhalation, skin contact, eye contact
Acute Effects

Inhalation: The vapor is extremely discomforting to the upper respiratory tract, may cause severe mucous membrane damage and may be harmful if inhaled.
Inhalation of quantities of liquid mist may be extremely hazardous, even lethal due to spasm, extreme irritation of larynx and bronchi, chemical pneumonitis and pulmonary edema.
A single severe exposure may cause coughing and choking; bleeding of nose, inflammation and occasionally ulceration of the nose, throat and larynx. Fluid on the lungs followed by generalized lung damage may follow.
Breathing of vapor may aggravate asthma and inflammatory or fibrotic pulmonary disease.
High concentrations cause necrosis of the tracheal and bronchial epithelium, pulmonary edema, atelectasis and emphysema and damage to the pulmonary blood vessels and liver.
Inhalation hazard is increased at higher temperatures.
The vapor from heated material is extremely discomforting to the upper respiratory tract and lungs if inhaled.
Continued severe exposure can result in pulmonary edema and corrosion of tissues in the nose and throat.

Eye: Hydrogen Chloride: The vapor is extremely discomforting to the eyes and is capable of causing pain and severe conjunctivitis. Corneal injury may develop, with possible permanent impairment of vision, if not promptly and adequately treated.
The material may be irritating to the eye, with prolonged contact causing inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.
Hydrochloric Acid: Eye contact is extremely painful and may cause rapid corneal damage. The liquid is extremely corrosive to the eyes and is capable of causing severe damage with loss of sight.
The vapor is highly discomforting and may be corrosive to the eyes. The vapor from heated material is extremely discomforting to the eyes.

Skin: The material is corrosive to the skin and may cause chemical burns.
Toxic effects may result from skin absorption. Bare unprotected skin should not be exposed to this material. The material may accentuate any pre-existing skin condition.
The vapor is discomforting to the skin.

Ingestion: Considered an unlikely route of entry in commercial/industrial environments.
The liquid is extremely corrosive if swallowed and is capable of causing burns to mouth, throat, esophagus, with extreme discomfort, pain and may be fatal if swallowed in quantity. Ingestion may result in nausea, abdominal irritation, pain and vomiting.

Carcinogenicity: NTP - Not listed; IARC - Group 3, Not classifiable as to carcinogenicity to humans; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Not listed; MAK - Not listed.

Chronic Effects: Chronic exposure may cause discoloration or erosion of the teeth, bleeding of the nose and gums; and ulceration of the nasal mucous membranes.
Repeated exposures of animals to concentrations of about 34 ppm produced no immediate toxic effects.
Workers exposed to hydrochloric acid suffered from gastritis and a number of cases of chronic bronchitis have also been reported.
Repeated or prolonged exposure to dilute solutions may cause dermatitis. Repeated exposure to low vapor concentrations can cause skin tenderness, bleeding of the nose and gums, chronic bronchitis, gastritis.

Section 4 - First Aid Measures

Inhalation: Remove to fresh air.
Lay patient down. Keep warm and rested.
If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital or doctor.

Eye Contact: Immediately hold the eyes open and flush continuously for at least 15 minutes with fresh running water. Ensure irrigation under eyelids by occasionally lifting the upper and lower lids.
Transport to hospital or doctor without delay. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Skin Contact: Immediately flush body and clothes with large amounts of water, using safety shower if available.
Quickly remove all contaminated clothing, including footwear.
Wash affected areas with water (and soap if available) for at least 15 minutes. Transport to hospital or doctor.

Ingestion: Contact a Poison Control Center. Rinse mouth out with plenty of water. Do NOT induce vomiting. Give a glass of water.

After first aid, get appropriate in-plant, paramedic, or community medical support.

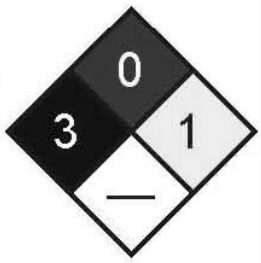
Note to Physicians: For acute or short-term repeated exposures to strong acids:
1.Airway problems may arise from laryngeal edema and inhalation exposure.
Treat with 100% oxygen initially.
2.Respiratory distress may require cricothyroidotomy if endotracheal intubation is contraindicated by excessive swelling.

3. Intravenous lines should be established immediately in all cases where there is evidence of circulatory compromise.
4.Strong acids produce a coagulation necrosis characterized by formation of a coagulum (eschar) as a result of the desiccating action of the acid on proteins in specific tissues.
INGESTION:
1.Immediate dilution (milk or water) within 30 minutes post-ingestion is recommended.
2.Do not attempt to neutralize the acid since exothermic reaction may extend the corrosive injury.
3.Be careful to avoid further vomiting since re-exposure of the mucosa to the acid is harmful. Limit fluids to one or two glasses in an adult.
4.Charcoal has no place in acid management.
5.Some authors suggest the use of lavage within 1 hour of ingestion.
SKIN:
1.Skin lesions require copious saline irrigation. Treat chemical burns as thermal burns with non-adherent gauze and wrapping.
2.Deep second-degree burns may benefit from topical silver sulfadiazine.
EYE:
1.Eye injuries require retraction of the eyelids to ensure thorough irrigation of the conjunctival cul-de-sacs. Irrigation should last at least 20-30 minutes. Do not use neutralizing agents or any other additives. Several liters of saline are required.
2.Cycloplegic drops (1% cyclopentolate for short-term use or 5% homatropine for longer term use), antibiotic drops, vasoconstrictive agents, or artificial tears may be indicated dependent on the severity of the injury.
3.Steroid eye drops should only be administered with the approval of a consulting ophthalmologist.

Section 5 - Fire-Fighting Measures

Flash Point: Nonflammable
Autoignition Temperature: Not applicable
LEL: Not applicable
UEL: Not applicable
Extinguishing Media: Water spray or fog; foam;
Bromochlorodifluoromethane (BCF) (where regulations permit); Dry agent; Carbon dioxide.

See DOT ERG



Fire Diamond

General Fire Hazards/Hazardous Combustion Products: Noncombustible liquid. Will not burn, but heat produces highly toxic fumes/vapors.
Heating may cause expansion or decomposition leading to violent rupture of containers. Decomposes on heating and produces toxic fumes of hydrogen chloride. Decomposition may produce toxic fumes of chlorine.
Reacts with metals producing flammable/explosive hydrogen gas. Contact with moisture or water may generate heat causing ignition. Reacts vigorously with alkalis. Moderate fire hazard when in contact with reducing agents.
Fire Incompatibility: Reacts with metals producing flammable/explosive hydrogen gas.
Avoid reactions with metals, metal oxides, hydroxides, amines, carbonates, alkaline materials, acetic anhydride, cyanides, sulphides, sulphites, phosphides, acetylides, borides, carbides, silicides, vinyl acetate, formaldehyde and potassium permanganate, unsaturated organics, metal acetylides, sulphuric acid.
Note: Compatibility with plastics should be confirmed prior to use.
Fire-Fighting Instructions: Contact fire department and tell them location and nature of hazard.
Wear full body protective clothing with breathing apparatus. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation. Cool fire-exposed containers with water spray from a protected location. If safe to do so, remove containers from path of fire. Equipment should be thoroughly decontaminated after use. Water spray or fog may be used to disperse vapor. Do not approach cylinders suspected to be hot. If safe to do so, stop flow of gas.

Section 6 - Accidental Release Measures

Small Spills: DO NOT touch the spill material. Clean up all spills immediately. Wear fully protective PVC clothing and breathing apparatus. Contain and absorb spill with sand, earth, inert material or vermiculite. Use soda ash or slaked lime to neutralize. Collect residues and place in labeled plastic containers with vented lids. Clear area of personnel and move upwind. Avoid breathing vapors and contact with skin and eyes. Do not exert excessive pressure on valve; do not attempt to operate damaged valve. Water spray or fog may be used to disperse vapor.

See DOT ERG

Large Spills: Contact fire department and tell them location and nature of hazard. Clear area of personnel and move upwind. Wear full body protective clothing with breathing apparatus. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation. Stop leak if safe to do so. Remove leaking cylinders to a safe place if possible. Release pressure under safe, controlled conditions by opening the valve. Do not exert excessive pressure on valve; do not attempt to operate damaged valve. Shut off all possible sources of ignition and increase ventilation. Water spray or fog may be used to disperse vapor. Use soda ash or slaked lime to neutralize.
Collect and seal in labeled drums for disposal. Wash spill area with large quantities of water. If contamination of

drains or waterways occurs, advise emergency services. After clean-up operations, decontaminate and launder all protective clothing and equipment before storing and reusing. DO NOT touch the spill material. Contain and absorb spill with sand, earth, inert material or vermiculite.
DO NOT USE WATER OR NEUTRALIZING AGENTS INDISCRIMINATELY ON LARGE SPILLS.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Avoid generating and breathing mist and vapor, breathing vapors and contact with skin and eyes.
Avoid physical damage to containers. Use in a well-ventilated area. Wear protective clothing and gloves when handling containers. Handle and open container with care.
WARNING: To avoid violent reaction, ALWAYS add material to water and NEVER water to material. When handling, DO NOT eat, drink or smoke. Always wash hands with soap and water after handling. Work clothes should be laundered separately. Use good occupational work practices. Observe manufacturer's storing and handling recommendations.
Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions are maintained.
Local exhaust ventilation may be required for safe working, i.e. to keep exposures below required standards; otherwise, PPE is required.
Keep dry. Reacts violently with water.
Transport containers on a trolley. Avoid sources of heat. DO NOT transfer gas from one cylinder to another.

Recommended Storage Methods: Packaging as recommended by manufacturer. Check that containers are clearly labeled.
Cylinder. Ensure the use of equipment rated for cylinder pressure. Ensure the use of compatible materials of construction. Valve protection cap to be in place until cylinder is secured, connected. Cylinder must be properly secured either in use or in storage. Cylinder valve must be closed when not in use or when empty. Segregate full from empty cylinders. WARNING: Suckback into cylinder may result in rupture. Use back-flow preventive device in piping.
Hydrochloric acid: Packs of 2.5 litres or less require a child-resistant closure. Glass container or Plastic carboy or Polylined drum.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: If risk of overexposure exists, wear air supplied breathing apparatus. Provide adequate ventilation in warehouse or closed storage areas. Use in a well-ventilated area. Local exhaust ventilation may be required for safe working, i. e. , to keep exposures below required standards; otherwise, PPE is required.

If risk of inhalation or overexposure exists, wear NIOSH-approved respirator or work in fume hood. Hydrogen chloride vapors will not be adequately absorbed by organic vapor respirators.

Personal Protective Clothing/Equipment:

Eyes: Chemical goggles. Full face shield.
DO NOT wear contact lenses. Contact lenses pose a special hazard; soft contact lenses may absorb irritants and all lenses concentrate them.

Hands/Feet: Neoprene gloves; rubber gloves. Nitrile gloves.
Safety footwear. Rubber boots.
Hydrochloric acid: Barrier cream and Neoprene gloves or Elbow length PVC gloves. Nitrile gloves.
PVC boots or PVC safety gumboots.

Respiratory Protection:
Exposure Range >5 to <50 ppm: Air Purifying, Negative Pressure, Half Mask
Exposure Range 50 to unlimited ppm: Self-contained Breathing Apparatus, Pressure Demand, Full Face
Cartridge Color: white

Other: Ensure there is ready access to a safety shower; Eyewash unit.
Acid-resistant overalls. Full protective suit. Operators should be trained in procedures for safe use of this material.

Glove Selection Index:

BUTYL	Best selection
BUTYL/NEOPRENE	Best selection
HYPALON	Best selection
NEOPRENE	Best selection
NEOPRENE/NATURAL	Best selection
NITRILE+PVC	Best selection
PE/EVAL/PE	Best selection
SARANEX-23	Best selection
VITON/NEOPRENE	Best selection
PVC	Best selection

NITRILE..... Best selection
NATURAL RUBBER..... Satisfactory; may degrade after 4 hours continuous immersion
NATURAL+NEOPRENE..... Satisfactory; may degrade after 4 hours continuous immersion
NAT+NEOPR+NITRILE ..... Poor to dangerous choice for other than short-term immersion

Section 9 - Physical and Chemical Properties

Appearance/General Info: Hydrogen chloride: Colorless, corrosive gas. Pungent suffocating odor. White fumes in moist air. Soluble in methanol, ethanol, ether and benzene.
Hydrochloric acid: Clear to light yellow (orange tint for inhibited grades) fuming corrosive liquid with sharp, suffocating odor.

Physical State: Hydrogen chloride: Compressed gas; Hydrochloric acid: Liquid
Odor Threshold: 0.26 to 0.3 ppm
Vapor Pressure (kPa): < 24.8 at 25 °C
Vapor Density (Air=1): 1.268 at 20 °C
Formula Weight: 36.461
Specific Gravity (H_2O=1, at 4 °C): < 1.19 at 20 °C
Evaporation Rate: Slow

pH: Hydrochloric acid: < 1
Boiling Point: -85 °C (-121 °F)
Freezing/Melting Point: -114.44 °C (-173.992 °F)
Volatile Component (% Vol): 100
Decomposition Temperature (°C): Not applicable
Water Solubility: 56.1 g/100 cc hot water at 60 °C

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Decomposes in the presence of moisture to produce corrosive acid. May generate sufficient heat to ignite combustible materials. Presence of heat source and direct sunlight (ultra-violet radiation). Product is considered stable under normal handling conditions. Hazardous polymerization will not occur.
Storage Incompatibilities: Hydrogen chloride: Segregate from most common metals and their alloys, alkalis, unsaturated organics, fluorine, metal carbides, metal acetylides, potassium permanganate and sulfuric acid. Compatibility with plastics should be confirmed prior to use.
Hydrochloric acid: Segregate from alkalies, oxidizing agents and chemicals readily decomposed by acids, i.e. cyanides, sulfides, carbonates. Avoid storage with metals, metal oxides, hydroxides, amines, carbonates, alkaline materials, acetic anhydride, cyanides, sulphides, sulphites, phosphides, acetylides, borides, carbides, silicides, vinyl acetate, formaldehyde and potassium permanganate. Reacts with zinc, brass, galvanized iron, aluminum, copper and copper alloys.

Section 11 - Toxicological Information

Toxicity
Inhalation (human) LC_{Lo}: 1300 ppm/30 m
Inhalation (human) LC_{Lo}: 3000 ppm/5 m
Inhalation (rat) LC_{50}: 3124 ppm/60 m
Inhalation (rat) LC_{50}: 4701 ppm/30 m
Oral (rat) LD_{50}: 900 mg/kg

Irritation
Eye (rabbit): 5 mg/30 s - mild

See *RTECS* MW 4025000, for additional data.

Section 12 - Ecological Information

Environmental Fate: No data found.
Ecotoxicity: TL_m Gambusia affinis (mosquito fish) 282 ppm/96 hr (fresh water) /Conditions of bioassay not specified; Lethal Lepomis macrochirus (bluegill sunfish) 3.6 mg/l/48 hr /Conditions of bioassay not specified; LC_{50} Cockle 330 to 1,000 mg/l/48 hr /Conditions of bioassay not specified; LC_{50} Carassius auratus (goldfish) 178 mg/l (1 to 2 hr survival time) /Conditions of bioassay not specified; LC_{50} Shore crab 240 mg/l/48 hr /Conditions of bioassay not specified; LC_{50} Shrimp 100 to 330 ppm/48 hr (salt water) /Conditions of bioassay not specified; LC_{100} Trout 10 mg/l 24 hr /Conditions of bioassay not specified
Biochemical Oxygen Demand (BOD): none

Section 13 - Disposal Considerations

Disposal: Recycle wherever possible. Consult manufacturer for recycling options. Treat and neutralize at an effluent treatment plant. Bury residue in an authorized landfill. Decontaminate empty containers with a lime slurry. Return empty containers to supplier or bury empty containers at an authorized landfill.
Return empty cylinders to supplier.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Note: This material has multiple possible HMT entries. Choose the appropriate one based on state and condition of specific material when shipped.

Shipping Name and Description: Hydrogen chloride, anhydrous
ID: UN1050
Hazard Class: 2.3 - Poisonous gas
Packing Group:
Symbols:
Label Codes: 2.3 - Poison Gas, 8 - Corrosive
Special Provisions: 3
Packaging: **Exceptions:** None **Non-bulk:** 304 **Bulk:** None
Quantity Limitations: **Passenger aircraft/rail:** Forbidden **Cargo aircraft only:** Forbidden
Vessel Stowage: **Location:** D **Other:** 40

Shipping Name and Description: Hydrochloric acid
ID: UN1789
Hazard Class: 8 - Corrosive material
Packing Group: II - Medium Danger
Symbols:
Label Codes: 8 - Corrosive
Special Provisions: A3, A6, B3, B15, IB2, N41, T8, TP2, TP12
Packaging: **Exceptions:** 154 **Non-bulk:** 202 **Bulk:** 242
Quantity Limitations: **Passenger aircraft/rail:** 1 L **Cargo aircraft only:** 30 L
Vessel Stowage: **Location:** C **Other:**

Shipping Name and Description: Hydrochloric acid
ID: UN1789
Hazard Class: 8 - Corrosive material
Packing Group: III - Minor Danger
Symbols:
Label Codes: 8 - Corrosive
Special Provisions: IB3, T4, TP1, TP12
Packaging: **Exceptions:** 154 **Non-bulk:** 203 **Bulk:** 241
Quantity Limitations: **Passenger aircraft/rail:** 5 L **Cargo aircraft only:** 60 L
Vessel Stowage: **Location:** C **Other:**

Section 15 - Regulatory Information

EPA Regulations:
RCRA 40 CFR: Not listed
CERCLA 40 CFR 302.4: Listed per CWA Section 311(b)(4) 5000 lb (2268 kg)
SARA 40 CFR 372.65: Listed
SARA EHS 40 CFR 355: Listed
RQ: 5000 lb
TPQ: 500 lb
TSCA: Listed

Section 16 - Other Information

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Group, Inc. extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

Material Safety Data Sheet Collection
Genium group inc.
1171 RiverFront Center, Amsterdam, NY 12010
(518) 842-4111

Issue Date: 2005-05

Section 1 - Chemical Product and Company Identification 54/60

Material Name: Sulfuric Acid **CAS Number:** 7664-93-9
Chemical Formula: H_2O_4S
Structural Chemical Formula: H_2SO_4
EINECS Number: 231-639-5
ACX Number: X1002217-4
Synonyms: ACIDE SULFURIQUE; ACIDO SOLFORICO; ACIDO SULFURICO; BATTERY ACID; BOV; DIHYDROGEN SULFATE; DIPPING ACID; ELECTROLYTE ACID; EPA PESTICIDE CHEMICAL CODE 078001; HYDROGEN SULFATE; MATTLING ACID; OIL OF VITRIOL; SCHWEFELSAEURELOESUNGEN; SULFURIC ACID; SULFURIC ACID (AQUEOUS); SULFURIC ACID,SPENT; SULPHURIC ACID; VITRIOL BROWN OIL; ZWAVELZUUROPLOSSINGEN
General Use: The manufacture of superphosphate fertilizer, inorganic and petro-chemicals, explosives and pigments.
Component of heavy duty metal cleaners, pickles.
In manufacture of rayon, cellulose film.
As battery electrolyte and also in electroplating processes.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
sulfuric acid	7664-93-9	>51
water	7732-18-5	remainder

OSHA PEL
TWA: 1 mg/m^3.

NIOSH REL
TWA: 1 mg/m^3.

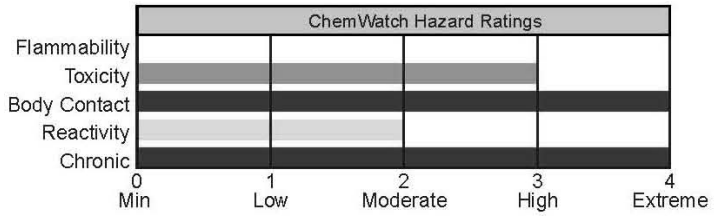
DFG (Germany) MAK
TWA: 0.1 mg/m^3; PEAK: 0.1 mg/m^3; Ceiling: 0.2 mg/m^3; measured as inhalable fraction of the aerosol.

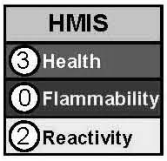
ACGIH TLV
TWA: 1 mg/m^3; STEL: 3 mg/m^3; A2 = as contained in strong inorganic acid mists.

IDLH Level
15 mg/m^3.

Section 3 - Hazards Identification

Fire Diamond





ANSI Signal Word
Danger!


Corrosive

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Colorless to dark-brown, oily, odorless liquid. Corrosive. Other Acute Effects: blindness. Chronic Effects: tooth erosion, GI disturbances, dermatitis. Reaction with water produces excessive heat.

Potential Health Effects

Target Organs: respiratory system, eyes, skin, teeth
Primary Entry Routes: inhalation, skin contact, eye contact
Acute Effects
Inhalation: The vapor is extremely discomforting to the upper respiratory tract and is capable of causing severe mucous membrane irritation, upper respiratory tract inflammation.
Exposure to high concentrations causes bronchitis and is characterized by the onset of hemorrhagic pulmonary edema.

Mists are highly irritating to eyes, mucous membranes and respiratory tract and high mist concentrations may lead to pulmonary edema.

Eye: HIGHLY CORROSIVE The liquid is extremely corrosive to the eyes and any contact may cause rapid tissue destruction and is capable of causing severe damage with loss of sight.
The mist is highly corrosive and contact may cause rapid tissue destruction.
The vapor is extremely discomforting to the eyes.
The material may produce severe irritation to the eye causing pronounced inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.

Skin: HIGHLY CORROSIVE. The liquid is extremely corrosive to the skin and any contact may cause rapid tissue destruction with severe burns.
The mist is highly discomforting to the skin and may cause deep ulceration to body tissue.
Topical application of a 10% solution to skin on the scapula or waist produces only negligible evidence of irritation.

Ingestion: HIGHLY CORROSIVE and Considered toxic by all exposure routes.
The liquid is extremely corrosive and may rapidly cause severe burns to the gastrointestinal tract and may be fatal if swallowed in quantity.
Considered an unlikely route of entry in commercial/industrial environments.

Carcinogenicity: NTP - Not listed; IARC - Group 1, Carcinogenic to humans; OSHA - Not listed; NIOSH - Not listed; ACGIH - Class A2, Suspected human carcinogen; EPA - Not listed; MAK - Not listed.

Chronic Effects: Repeated minor exposure to mists can cause erosion of teeth and inflammation of the upper respiratory tract leading to chronic bronchitis.
Repeated skin contact with dilute solutions may cause dermatitis.
Lungs of sulfuric acid plant workers appear to be less affected than the lungs of workers exposed to "dust".
There is evidence that the corrosion of tooth enamel occurs at 1 mg/m^3 but that acclimatized workers could tolerate three to four times that level. Forming room workers in a battery factory exposed to 3 to 16 mg/m^3 sulfuric acid mist concentrations exhibited the most serious signs of erosion whilst charging room workers exposed to 0.08 to 2.5 mg/m^3 were affected to a lesser degree.
Workers chronically exposed to sulfuric acid mists may show various skin lesions, tracheobronchitis, stomatitis, conjunctivitis and gastritis.
Increased risk of laryngeal cancer is associted with chronic exposures.

Section 4 - First Aid Measures

Inhalation: Remove to fresh air.
Lay patient down. Keep warm and rested.
If available, administer medical oxygen by trained personnel.
If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital or doctor, without delay.

See DOT ERG

Eye Contact: Immediately hold the eyes open and flush continuously for at least 15 minutes with fresh running water. Ensure irrigation under eyelids by occasionally lifting the upper and lower lids.
Transport to hospital or doctor without delay. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Skin Contact: Immediately flush body and clothes with large amounts of water, using safety shower if available.
Quickly remove all contaminated clothing, including footwear.
Wash affected areas with water (and soap if available) for at least 15 minutes. Transport to hospital or doctor.
DO NOT attempt to neutralize burns with alkaline solutions.

Ingestion: Rinse mouth out with plenty of water.
Contact a Poison Control Center.
Do NOT induce vomiting. Give a glass of water.

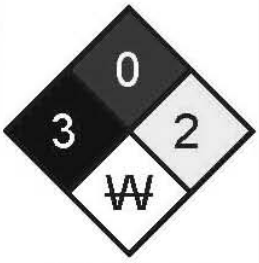
After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: For acute or short-term repeated exposures to strong acids:
1.Airway problems may arise from laryngeal edema and inhalation exposure.
Treat with 100% oxygen initially.
2.Respiratory distress may require cricothyroidotomy if endotracheal intubation is contraindicated by excessive swelling.
3. Intravenous lines should be established immediately in all cases where there is evidence of circulatory compromise.
4.Strong acids produce a coagulation necrosis characterized by formation of a coagulum (eschar) as a result of the desiccating action of the acid on proteins in specific tissues.
INGESTION:
1.Immediate dilution (milk or water) within 30 minutes post-ingestion is recommended.
2.Do not attempt to neutralize the acid since exothermic reaction may extend the corrosive injury.
3.Be careful to avoid further vomiting since re-exposure of the mucosa to the acid is harmful. Limit fluids to one or two glasses in an adult.
4.Charcoal has no place in acid management.
5.Some authors suggest the use of lavage within 1 hour of ingestion.

SKIN:
1.Skin lesions require copious saline irrigation. Treat chemical burns as thermal burns with non-adherent gauze and wrapping.
2.Deep second-degree burns may benefit from topical silver sulfadiazine.
EYE:
1.Eye injuries require retraction of the eyelids to ensure thorough irrigation of the conjunctival cul-de-sacs. Irrigation should last at least 20-30 minutes. Do not use neutralizing agents or any other additives. Several liters of saline are required.
2.Cycloplegic drops (1% cyclopentolate for short-term use or 5% homatropine for longer term use), antibiotic drops, vasoconstrictive agents, or artificial tears may be indicated dependent on the severity of the injury.
3.Steroid eye drops should only be administered with the approval of a consulting ophthalmologist.

Section 5 - Fire-Fighting Measures

See DOT ERG



Fire Diamond

Flash Point: Nonflammable
Autoignition Temperature: Not applicable
LEL: Not applicable
UEL: Not applicable
Extinguishing Media: Use extinguishing media suitable for surrounding area. Water spray or fog, from a safe distance only.
General Fire Hazards/Hazardous Combustion Products: HIGHLY CORROSIVE.
Noncombustible liquid. Reacts vigorously with water.
Heating may cause expansion or decomposition leading to violent rupture of containers.
Contact with readily oxidizable organic material may cause ignition /fire.
Reacts with metals producing flammable/explosive hydrogen gas.
Decomposes on heating and produces acrid and toxic fumes of sulfur oxides (SO_x).
Fire Incompatibility: Reacts with mild steel, galvanized steel/zinc producing hydrogen gas which may form an explosive mixture with air.
Contact with readily oxidizable organic material may cause ignition /fire.
Avoid any contamination of this material as it is very reactive and any contamination is potentially hazardous.
Fire-Fighting Instructions: Contact fire department and tell them location and nature of hazard.
May be violently or explosively reactive. Wear full body protective clothing with breathing apparatus. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation.
Use water delivered as a fine spray to control fire and cool adjacent area.
Avoid spraying water onto liquid pools.
Do not approach containers suspected to be hot.
Cool fire-exposed containers with water spray from a protected location.
If safe to do so, remove containers from path of fire.
Equipment should be thoroughly decontaminated after use.

Section 6 - Accidental Release Measures

See DOT ERG

Small Spills: Clean up all spills immediately.
Avoid breathing vapors and contact with skin and eyes.
Control personal contact by using protective equipment.
Contain and absorb spill with sand, earth, inert material or vermiculite.
Wipe up. Place in a suitable labeled container for waste disposal.
Use soda ash or slaked lime to neutralize.
Large Spills: DO NOT touch the spill material. Clear area of personnel and move upwind.
Contact fire department and tell them location and nature of hazard.
May be violently or explosively reactive. Wear full body protective clothing with breathing apparatus. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation.
Stop leak if safe to do so.
Contain spill with sand, earth or vermiculite.
Collect recoverable product into labeled containers for recycling.
Neutralize/decontaminate residue.
Collect solid residues and seal in labeled drums for disposal.
Wash area and prevent runoff into drains.
After clean-up operations, decontaminate and launder all protective clothing and equipment before storing and reusing.
If contamination of drains or waterways occurs, advise emergency services.
DO NOT USE WATER OR NEUTRALIZING AGENTS INDISCRIMINATELY ON LARGE SPILLS.
Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Avoid generating and breathing mist. Avoid all personal contact, including inhalation.
Wear protective clothing when risk of exposure occurs.
Use in a well-ventilated area.
WARNING: To avoid violent reaction, ALWAYS add material to water and NEVER water to material.
Avoid smoking, bare lights or ignition sources.
Avoid contact with incompatible materials.
When handling, DO NOT eat, drink or smoke.
Keep containers securely sealed when not in use. Avoid physical damage to containers. Always wash hands with soap and water after handling. Work clothes should be laundered separately.
Launder contaminated clothing before reuse.
Use good occupational work practices. Observe manufacturer's storing and handling recommendations. Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions are maintained.
Recommended Storage Methods: Glass carboy. Glass container is suitable for laboratory quantities.
Plastic carboy. Polylined drum.
Check that containers are clearly labeled.
Packaging as recommended by manufacturer.
DO NOT use mild steel or galvanized containers.
Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Use in a well-ventilated area.
General exhaust is adequate under normal operating conditions.
Local exhaust ventilation may be required in special circumstances.
If risk of overexposure exists, wear NIOSH-approved respirator. Correct fit is essential to ensure adequate protection.
Provide adequate ventilation in warehouses and enclosed storage areas.
Personal Protective Clothing/Equipment:
Eyes: Chemical goggles. Full face shield.
Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.
Hands/Feet: Wear chemical protective gloves, eg. PVC.
Wear safety footwear or safety gumboots, eg. Rubber.
Respiratory Protection:
Exposure Range >1 to 10 mg/m^3: Air Purifying, Negative Pressure, Half Mask
Exposure Range >10 to <15 mg/m^3: Air Purifying, Negative Pressure, Full Face
Exposure Range 15 to unlimited mg/m^3: Self-contained Breathing Apparatus, Pressure Demand, Full Face
Cartridge Color: white with dust/mist prefilter (use P100 or consult supervisor for appropriate dust/mist prefilter)
Other: Overalls. PVC apron. PVC protective suit may be required if exposure severe.
Eyewash unit. Ensure there is ready access to a safety shower.
Glove Selection Index:
NATURAL RUBBER..... Best selection
NATURAL+NEOPRENE..... Best selection
NEOPRENE..... Best selection
NEOPRENE/NATURAL..... Best selection
NITRILE..... Best selection
PE..... Best selection
PVC..... Best selection
SARANEX-23 ..... Best selection

Section 9 - Physical and Chemical Properties

Appearance/General Info: Colorless, oily, dense, HIGHLY CORROSIVE liquid. Faint acid odor.
Material is a powerful oxidizing and dehydrating agent causing rapid human tissue destruction on contact.
Concentrated acid is very exothermic (generates heat) when mixed with water.
DANGER: Adding water to acid will cause violent steam explosion, scattering corrosive acid. Always add acid slowly to water.
Mixes with alcohol in all proportions. Available in technical, pure and analytical grades

Physical State: Liquid
Vapor Pressure (kPa): 0.133 at 146 °C
Vapor Density (Air=1): 3.40
Formula Weight: 98.07
Specific Gravity (H_2O=1, at 4 °C): 1.6-1.84 at 15 °C
Evaporation Rate: Non Vol. at 38 °C
pH: < 1
pH (1% Solution): 1
Boiling Point: About 290 °C (554 °F)
Freezing/Melting Point: 10.36 °C (50.648 °F)
Decomposition Temperature (°C): 340
Water Solubility: Soluble in water

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Product is considered stable. Hazardous polymerization will not occur.
Storage Incompatibilities: Segregate from alkalies, oxidizing agents and chemicals readily decomposed by acids, i.e. cyanides, sulfides, carbonates.
Reacts vigorously with water and alkali.
Contact with readily oxidizable organic material may cause ignition /fire.
Avoid contamination of water, foodstuffs, feed or seed.

Section 11 - Toxicological Information

Toxicity
Oral (rat) LD_{50}: 2140 mg/kg
Inhalation (rat) LC_{50}: 510 $mg/m^3/2h$
Inhalation (human) TC_{Lo}: 3 $mg/m^3/24w$

Irritation
Eye (rabbit): 1.38 mg SEVERE
Eye (rabbit): 5 mg/30sec SEVERE

See *RTECS* WS 5600000, for additional data.

Section 12 - Ecological Information

Environmental Fate: No data found.
Ecotoxicity: TL_m Lepomis macrochirus (bluegill) 24.5 ppm/24 hr fresh water /Conditions of bioassay not specified; LC_{50} Flounder 100 to 330 mg/l/48 hr aerated water /Conditions of bioassay not specified; LC_{50} Shrimp 80 to 90 mg/l/48 hr aerated water /Conditions of bioassay not specified; LC_{50} Prawn 42.5 ppm/48 hr salt water /Conditions of bioassay not specified
BCF: no food chain concentration potential
Biochemical Oxygen Demand (BOD): none

Section 13 - Disposal Considerations

Disposal: Recycle wherever possible or consult manufacturer for recycling options.
Follow applicable federal, state, and local regulations.
Treat and neutralize at an effluent treatment plant.
Use soda ash or slaked lime to neutralize.
Recycle containers, otherwise dispose of in an authorized landfill.
Bury residue in an authorized landfill.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Shipping Name and Description: Sulfuric acid *with more than 51 percent acid*
ID: UN1830
Hazard Class: 8 - Corrosive material
Packing Group: II - Medium Danger
Symbols:
Label Codes: 8 - Corrosive
Special Provisions: A3, A7, B3, B83, B84, IB2, N34, T8, TP2, TP12
Packaging: **Exceptions:** 154 **Non-bulk:** 202 **Bulk:** 242
Quantity Limitations: **Passenger aircraft/rail:** 1 L **Cargo aircraft only:** 30 L
Vessel Stowage: **Location:** C **Other:** 14

Section 15 - Regulatory Information

EPA Regulations:
RCRA 40 CFR: Not listed
CERCLA 40 CFR 302.4: Listed per CWA Section 311(b)(4) 1000 lb (453.5 kg)
SARA 40 CFR 372.65: Listed
SARA EHS 40 CFR 355: Listed
RQ: 1000 lb
TPQ: 1000 lb
TSCA: Listed

Section 16 - Other Information

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Group, Inc. extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

Material Safety Data Sheet Collection
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Issue Date: 2004-07

Section 1 - Chemical Product and Company Identification 51/58

Material Name: Methanol
CAS Number: 67-56-1
Chemical Formula: CH_4O
Structural Chemical Formula: CH_3OH
EINECS Number: 200-659-6
ACX Number: X1001287-2
Synonyms: ALCOHOL,METHYL; ALCOOL METHYLIQUE; ALCOOL METILICO; CARBINOL; X-CIDE 402 INDUSTRIAL BACTERICIDE; COAT-B1400; COLONIAL SPIRIT; COLONIAL SPIRITS; COLUMBIAN SPIRIT; COLUMBIAN SPIRITS; EPA PESTICIDE CHEMICAL CODE 053801; EUREKA PRODUCTS CRIOSINE DISINFECTANT; EUREKA PRODUCTS,CRIOSINE; FREERS ELM ARRESTER; IDEAL CONCENTRATED WOOD PRESERVATIVE; METANOL; METANOLO; METHANOL; METHYL ALCOHOL; METHYL HYDRATE; METHYL HYDROXIDE; METHYLALKOHOL; METHYLOL; METYLOWY ALKOHOL; MONOHYDROXYMETHANE; PMC REJEX-IT F-40ME; PYROLIGNEOUS SPIRIT; PYROXYLIC SPIRIT; PYROXYLIC SPIRITS; SURFLO-B17; WILBUR-ELLIS SMUT-GUARD; WOOD ALCOHOL; WOOD NAPHTHA; WOOD SPIRIT
Derivation: Prepared by wood pyrolysis; non-catalytic oxidation of hydrocarbons; as a by-product in the fisher-tropsch synthesis; or by reduction of carbon monoxide.
General Use: Used as an industrial solvent; starting material for organic synthesis; antifreeze for windshield washer fluid; in fuel antifreezes; gasoline octane booster; fuel for stoves; extractant for oils; denaturing ethanol; softening agent; food additive; in paint, varnish removers, and embalming fluids; in the manufacture of photographic film, celluloid, textile soap, wood stains, coated fabrics, shatterproof glass, paper coating, waterproofing formulations, artificial leather, dyes.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
Methanol	67-56-1	ca 100% vol

Trace Impurities: (Grade A): Acetone and aldehydes < 30 ppm, acetic acid < 30 ppm

OSHA PEL
TWA: 200 ppm; 260 mg/m^3.

OSHA PEL Vacated 1989 Limits
TWA: 200 ppm; 260 mg/m^3;
STEL: 250 ppm; 325 mg/m^3.

ACGIH TLV
TWA: 200 ppm; STEL: 250 ppm; skin.

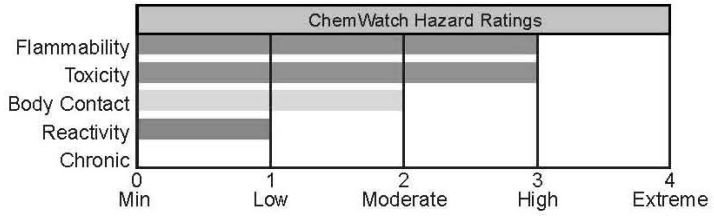
NIOSH REL
TWA: 200 ppm, 260 mg/m^3;
STEL: 250 ppm, 325 mg/m^3;
skin.

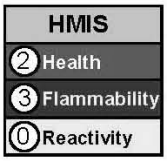
IDLH Level
6000 ppm.

DFG (Germany) MAK
TWA: 200 ppm; PEAK: 800 ppm; skin.

Section 3 - Hazards Identification

Fire Diamond





ANSI Signal Word
Warning!


Flammable

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Methanol is a colorless liquid with a slight alcohol odor when pure, or disagreeably pungent odor when crude. It is irritating to the eyes, skin, and respiratory tract. Exposure may result in headache, visual disturbance, blindness, and respiratory failure. Reproductive effects have been reported in animal testing. This flammable liquid is a moderate explosion hazard. When heated to decomposition, methanol emits carbon oxides (CO_x), formaldehyde, acrid smoke, and irritating fumes.

Potential Health Effects

Target Organs: Eyes, skin, central nervous system (CNS), gastrointestinal (GI) tract, respiratory system

Primary Entry Routes: Inhalation, ingestion, skin and/or eye contact/absorption

Acute Effects

Inhalation: Irritation, breathing difficulty, headache, drowsiness, vertigo, light-headedness, nausea, vomiting, acidosis (decreased blood alkalinity), visual disturbance, and at high concentrations, CNS damage, convulsions, circulatory collapse, respiratory failure, coma and blindness can result from inhalation of methanol vapor. Concentration >= 200 ppm may cause headache; 50,000 ppm can cause death within 1-2 hrs.

Eye: Contact with liquid may result in irritation, inflamed lids, light sensitization, and superficial lesions.

Skin: Contact may cause irritation, dermatitis, swelling, scaling, and systemic effects listed under inhalation.

Ingestion: GI irritation and systemic effects (see Inhalation). Symptoms may be delayed 18-48 hours. Fatal dose - 2 to 8 ounces.

Carcinogenicity: NTP - Not listed; IARC - Not listed; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Not listed; MAK - Not listed.

Medical Conditions Aggravated by Long-Term Exposure: None reported.

Chronic Effects: Exposure to methanol vapors has caused conjunctivitis, headache, giddiness, insomnia, GI disturbance, impaired vision. CNS damage is also likely. Methanol is slowly eliminated from the body; exposure is considered cumulative over the short term.

Section 4 - First Aid Measures

Inhalation: Remove exposed person to fresh air and support breathing as needed.

Eye Contact: *Do not* allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water for at least 15 minutes. Consult a physician or ophthalmologist if pain or irritation develops.

Skin Contact: *Quickly* remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. Wash exposed area with soap and water. For reddened or blistered skin, consult a physician.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center. Unless the poison control center advises otherwise, have the *conscious and alert* person drink 1 to 2 glasses of water, then induce vomiting.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Follow emesis with rehydration, correction of acidosis, and folate to enhance formate oxidation. Consider IV administration of ethanol (if blood methanol >20 mg/dL) to show metabolic oxidation of methanol. Assay formic acid in urine, blood pH and plasma bicarbonate.

Section 5 - Fire-Fighting Measures

Flash Point: 54 °F (12 °C), Closed Cup

Burning Rate: 1.7 mm/min

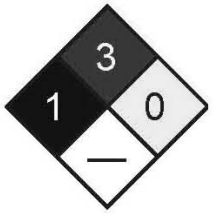
Autoignition Temperature: 867 °F (464 °C)

LEL: 6.0% v/v

UEL: 36% v/v

Flammability Classification: OSHA Class IB Flammable Liquid.

Extinguishing Media: Use dry chemical, carbon dioxide, water spray, fog or alcohol-resistant foam. A water spray may be used to cool fire-exposed containers, and flush spills away from ignition sources.



Fire Diamond

General Fire Hazards/Hazardous Combustion Products: Heating methanol to decomposition can produce carbon oxides (CO_x), formaldehyde, acrid smoke, and irritating fumes. Can form explosive mixtures in the air. The heavier-than-air vapors of methanol may travel along low-lying surfaces to distant sources of ignition and flash back to the material source. Containers may explode in heat of fire.

Fire-Fighting Instructions: *Do not* scatter material with any more water than needed to extinguish fire. *Do not* release runoff from fire control methods to sewers or waterways. Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode.

Section 6 - Accidental Release Measures

Spill/Leak Procedures: Isolate spill area for at least 330-660 feet (100-200 m) in all directions. Fully encapsulating, vapor protective clothing should be worn for spills and leaks with no fire. Eliminate all ignition sources (no smoking, flares, sparks or flames in immediate area). Ground all equipment used when handling this product. *Do not* touch or walk through spilled material. Stop leak if you can do it without risk. Prevent entry into waterways, sewers, basements or confined areas. A vapor suppressing foam may be used to reduce vapors.

Small Spills: Absorb with earth, sand or other non-combustible material and transfer to containers for later disposal. Use clean non-sparking tools to collect absorbed material.

Large Spills: Dike far ahead of liquid spill for later disposal. *Do not* release into sewers or waterways. Ground all equipment. Use non-sparking tools.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Avoid vapor inhalation, and skin and eye contact. Use only with ventilation sufficient to reduce airborne concentrations to non-hazardous levels (see Sec. 2). Wear protective gloves, goggles, and clothing (see Sec. 8). Keep away from heat and ignition sources. Ground and bond all containers during transfers to prevent static sparks. Use non-sparking tools to open and close containers.

Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Recommended Storage Methods: Store in tightly closed container in cool, well-ventilated area, away from heat, ignition sources and incompatibles (see Sec. 10). Equip drums with self-closing valves, pressure vacuum bungs, and flame arrestors.

Regulatory Requirements: Follow applicable OSHA regulations. Also 29 CFR 1910.106 for Class 1B Flammable Liquids.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: To prevent static sparks, electrically ground and bond all containers and equipment used in shipping, receiving, or transferring operations. Provide general or local exhaust ventilation systems to maintain airborne concentrations as low as possible. Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.

Administrative Controls: Enclose operations and/or provide local explosion-proof exhaust ventilation at the site of chemical release. Where possible, transfer methanol from drums or other storage containers to process containers. Minimize sources of ignition in surrounding areas.

Personal Protective Clothing/Equipment: Wear chemically protective gloves, boots, aprons, and gauntlets of butyl rubber, Teflon, Viton, Saranex, 4H, Responder, Trellchem HPS, or Tychem 10000 (Breakthrough Time (BT) >8 hr) to prevent skin contact. Natural rubber, neoprene, nitrile rubber, polyethylene, polyvinyl alcohol and CPF 3 may degrade after contact and are not recommended. Wear splash-proof chemical safety goggles, and face shield, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Contact lenses are not eye protective devices. Appropriate eye protection must be worn instead of, or in conjunction with contact lenses.

Respiratory Protection: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/ NIOSH-approved respirator. For concentrations <= 2000 ppm, use a supplied air respirator; <= 5000 ppm, supplied air (SA) respirator in continuous flow mode; <= 6000 ppm, SA respirator with tight-fitting face mask operated in continuous flow mode, or SCBA with full facepiece, or SA respirator with full facepiece; > IDLH/unknown/emergency, SCBA with full facepiece operated in pressure-demand or other positive-pressure mode, or SA respirator with full facepiece operated in pressure-demand or other positive-pressure mode in combination with auxiliary SCBA operated in pressure-demand or other positive-pressure mode. For escape, use an appropriate escape-type SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen- deficient atmospheres.* If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas.

Other: Separate contaminated work clothes from street clothes. Launder before reuse. Remove this material from your shoes and clean personal protective equipment. Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work area.

Section 9 - Physical and Chemical Properties

Appearance/General Info: Colorless; slight alcohol odor when pure, disagreeably pungent odor when crude.

Physical State: Liquid

Vapor Pressure (kPa): 127 mm Hg at 77 °F (25 °C)

Vapor Density (Air=1): 1.11

Bulk Density: 6.59 lbs/gal at 68 F (20 °C)

Formula Weight: 32.04

Density: 0.796 g/mL at 59 °F (15 °C)

Specific Gravity (H_2O=1, at 4 °C): 0.81 at 0 °C/4 °C

Refractive Index: 1.3292 at 68 °F (20 °C)

pH: Slightly acidic

Boiling Point: 148 °F (64.7 °C) at 760 mm Hg

Freezing/Melting Point: -144.04 °F (-97.8 °C)
Viscosity: 0.614 mPa sec
Surface Tension: 22.61 dynes/cm
Ionization Potential (eV): 10.84 eV
Water Solubility: Miscible
Other Solubilities: Ethanol, acetone, benzene, chloroform, DMSO, ether, ketones, most organic solvents.

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Methanol is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur. Vapor inhalation, oxidizers.

Storage Incompatibilities: Include beryllium dihydride, metals (potassium, magnesium), oxidants (barium perchlorate, bromine, chlorine, hydrogen peroxide, sodium hypochlorite, phosphorus trioxide), potassium tertbutoxide, carbon tetrachloride and metals, chloroform and heat, diethyl zinc, alkyl aluminum salts, acetyl bromide, chloroform and sodium hydroxide, cyanuric chloride, nitric acid, chromic anhydride, lead perchlorate.

Hazardous Decomposition Products: Thermal oxidative decomposition of methanol can produce carbon oxides (CO_x), formaldehyde, acrid smoke, and irritating fumes.

Section 11 - Toxicological Information

Acute Oral Effects:

Rat, oral, LD_{50}: 5628 mg/kg.

Human, oral, LD_{Lo}: 428 mg/kg produced toxic effects: behavioral - headache; lungs, thorax, or respiration - other changes.

Human, oral, LD_{Lo}: 143 mg/kg produced optic nerve neuropathy, dyspnea, nausea or vomiting.

Acute Inhalation Effects:

Rat, inhalation, LC_{50}: 64000 ppm/4 hr.

Human, inhalation, TC_{Lo}: 300 ppm produced visual field changes, headache; lungs, thorax, or respiration - other changes.

Acute Skin Effects:

Rabbit, skin, LD_{50}: 15800 mg/kg.

Monkey, skin, LD_{Lo}: 393 mg/kg.

Irritation Effects:

Rabbit, standard Draize test: 100 mg/24 hr resulted in moderate irritation.

Rabbit, standard Draize test: 20 mg/24 hr resulted in moderate irritation.

Other Effects:

Rat, oral: 10 µmol/kg resulted in DNA damage.

Rat, inhalation: 50 mg/m^3/12 hr/13 weeks intermittently produced degenerative changes to brain and coverings; muscle contraction or spasticity.

Rat, inhalation: 2610 ppm/6 hr/4 weeks intermittently produced toxic effects: endocrine - changes in spleen weight.

Multiple Dose Toxicity Effects - Rat, oral: 12 g/kg/8 weeks intermittently produced toxic effects: behavioral - ataxia; behavioral - alteration of operant conditioning.

Human, lymphocyte: 300 mmol/L resulted in DNA inhibition.

Rat (female), oral: 7500 mg/kg, administered during gestational days 17-19 produced effects on newborn - behavioral.

Rat (female), oral: 35295 mg/kg administered during gestational days 1-15 produced effects on the fertility index; pre implantation mortality; and post-implantation mortality.

Rat (female), inhalation: 20000 ppm/7 hr, administered during gestational days 1-22 produced specific developmental abnormalities - musculoskeletal system; cardiovascular (circulatory) system; urogenital system.

Rat (male), oral: 200 ppm/20 hr, 78 weeks prior to mating produced paternal effects - testes, epididymis, sperm duct.

See NIOSH, *RTECS* PC1400000, for additional data.

Section 12 - Ecological Information

Environmental Fate: Bioconcentration (BCF, estimated at 0.2) is not expected to be significant. Physical removal from air can occur via rainfall. Relatively rapid evaporation from dry surfaces is likely to occur. If released to the atmosphere, it degrades via reaction with photochemically produced hydroxyl radicals with an approximate half-life of 17.8 days. If released to water or soil, biodegradation is expected to occur. A low K_{oc} indicates little sorption and high mobility in the soil column.

Ecotoxicity: Trout, LC_{50}: 8,000 mg/L/48 hr; *Pimephales promelas* (fathead minnow) LC_{50}: 29.4 g/L/96 hr.

Henry's Law Constant: 4.55 x10^{-6} atm-m^3/mole at 77 °F (25 °C)

Octanol/Water Partition Coefficient: log K_{ow} = -0.77

Soil Sorption Partition Coefficient: K_{oc} = 0.44

Section 13 - Disposal Considerations

Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

Section 14 - Transport Information

DOT Transportation Data (49 CFR 172.101):

Shipping Name: Methanol
Hazard Class: 3
ID No.: UN1230
Packing Group: II
Label: FLAMMABLE LIQUID

Section 15 - Regulatory Information

EPA Regulations:
RCRA 40 CFR: Listed U154 Ignitable Waste
CERCLA 40 CFR 302.4: Listed per RCRA Section 3001 5000 lb (2268 kg)
SARA 40 CFR 372.65: Listed
SARA EHS 40 CFR 355: Not listed
TSCA: Listed

Section 16 - Other Information

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Group, Inc. extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

Material Safety Data Sheet Collection
Genium Group, Inc.
1171 RiverFront Center
Amsterdam, NY 12010
(518) 842-4111

Issue Date: 2004-07

Section 1 - Chemical Product and Company Identification 54/58

Material Name: Isobutene **CAS Number:** 115-11-7
Chemical Formula: C_4H_8
Structural Chemical Formula: $(CH_3)_2C=CH_2$
EINECS Number: 204-066-3
ACX Number: X1003822-9
Synonyms: Isobutene; ISOBUTYLENE; ASYM-DIMETHYLETHYLENE; GAMMA-BUTYLENE; 1,1-DIMETHYLETHYLENE; ISO-BUTENE; ISOBUTENE; ISOPROPYLIDENEMETHYLENE; LIQUEFIED PETROLEUM GAS; 2-METHYL-1-PROPENE; 2-METHYLPROPENE; 2-METHYLPROPYLENE; 1-PROPENE,2-METHYL-; PROPENE,2-METHYL-; UNSYM. DIMETHYLETHYLENE
General Use: Production of butene polymers used as adhesives, tackifiers, oil additives.
Butyl rubbers, copolymer resins with butadiene, acrylates and methacrylates.
Also to produce anti-oxidants for foods, food supplements, plastics and in production of isooctane and high-octane aviation gasoline.
Used in closed pressurized systems, fitted with safety relief valve.
Vented gas is flammable, denser than air and will spread. Vent path must not contain ignition sources, pilot lights, bare flames.

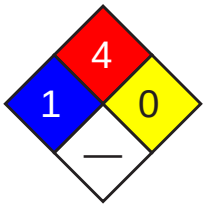
Section 2 - Composition / Information on Ingredients

Name	CAS	%
isobutene	115-11-7	>99

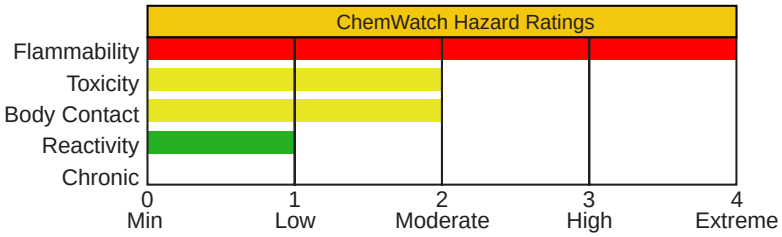
OSHA PEL **NIOSH REL**

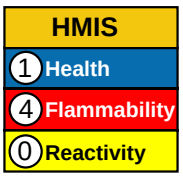
ACGIH TLV

Section 3 - Hazards Identification



Fire Diamond





ANSI Signal Word

Danger!


Flammable

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Colorless gas. Simple asphyxiant which can displace available oxygen; initial symptoms: rapid respiration, air hunger, diminished mental alertness, impaired muscular coordination. Can form explosive mixtures in air. Flammable.

Potential Health Effects

Target Organs: None reported
Primary Entry Routes: inhalation
Acute Effects
Inhalation: The gas is a simple asphyxiant (precludes access to oxygen) and is harmful if exposure is prolonged and inhalation may cause loss of consciousness.
Acute effects from inhalation of high concentrations of gas / vapor are pulmonary irritation, including coughing, with nausea; central nervous system depression - characterized by headache and dizziness, increased reaction time, fatigue and loss of coordination.

If exposure to highly concentrated atmosphere of gas is prolonged this may lead to narcosis, unconsciousness, even coma, and unless resuscitated, death.
Iso-butene is a simple asphyxiant and may have a narcotic action.
Material is highly volatile and may quickly form concentrated atmosphere in confined or unventilated area. Vapor is heavier than air and may displace and replace air in breathing zone, acting as a simple asphyxiant. This may happen with little warning of overexposure.
Hydrocarbons may sensitize the heart to adrenalin and other circulatory catecholamines; as a result cardiac arrhythmias and ventricular fibrillation may occur. Abrupt collapse may produce traumatic injury.
Central nervous system (CNS) depression may be evident early. Symptoms of moderate poisoning may include giddiness, headache, dizziness and nausea.
Serious poisonings may result in respiratory depression and may be fatal.
The paraffin gases C1-4 are practically non-toxic below their lower flammability limits (18000-50000 ppm). Above this level, incidental effects include CNS depression and irritation but these are reversible upon cessation of the exposure. The C3 and iso-C5 hydrocarbons show increasing narcotic properties; branching of the chain also enhances the effect.
The C4 hydrocarbons appear to be more highly neurotoxic than the C3 and C5 members. Several fatalities due to voluntary inhalation of butane have been reported, possibly due to central, respiratory and circulatory effects resulting from anesthesia, laryngeal edema, chemical pneumonia or the combined effects of cardiac toxicity and increased sympathomimetic effects.
Inhalation of petroleum gases may produce narcosis, due in part to olefinic impurities. Displacement of oxygen in the air may cyanosis.
If present in sufficient quantity these gases may reduce the oxygen level to below 18% producing asphyxiation.
Symptoms include rapid respiration, mental dullness, lack of coordination, poor judgement, nausea and vomiting.
The onset of cyanosis may lead to unconsciousness and death.

Eye: The liquid is highly discomforting and may cause severe cold burns and is capable of causing pain and severe conjunctivitis.
Corneal injury may develop, with possible permanent impairment of vision, if not promptly and adequately treated.
The gas is regarded as non-irritating to the eyes.

Skin: Vaporizing liquid causes rapid cooling and contact may cause cold burns, frostbite.The liquid is discomforting to the skin and may rapidly cause severe cold burns.
Bare unprotected skin should not be exposed to this material.
There is no evidence of skin absorption but contact may cause frostbite,

Ingestion: Overexposure is unlikely in this form.
Considered an unlikely route of entry in commercial/industrial environments.
The liquid is highly discomforting if swallowed and may cause severe cold burns.

Carcinogenicity: NTP - Not listed; IARC - Not listed; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Not listed; MAK - Not listed.

Chronic Effects: Chronic overexposure may produce dermatitis.

Section 4 - First Aid Measures

Inhalation: Avoid becoming a casualty and remove to fresh air.
Lay patient down. If breathing is shallow or has stopped, ensure clear airway and apply resuscitation.
If available, medical oxygen should be administered by trained personnel.
Transport to hospital or doctor, without delay.

Eye Contact: Immediately hold the eyes open and flush continuously for at least 15 minutes with fresh running water.
Ensure irrigation under eyelids by occasionally lifting the upper and lower lids.
Transport to hospital or doctor without delay. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Skin Contact: In case of cold burns (frost-bite): Bathe the affected area immediately in cold water for 10 to 15 minutes, immersing if possible and without rubbing.
Do not apply hot water or radiant heat. Apply a clean, dry dressing.
Transport to hospital or doctor.

Ingestion: Contact a Poison Control Center. DO NOT induce vomiting. Observe the patient carefully. Never give liquid to a person showing signs of being sleepy or with reduced awareness; i.e. becoming unconscious. Give water (or milk) to rinse out mouth. Then provide liquid slowly and as much as casualty can comfortably drink. Transport to hospital or doctor without delay.

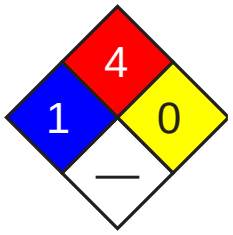
After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: For acute or short-term repeated exposures to petroleum distillates or related hydrocarbons:
1.Primary threat to life from pure petroleum distillate ingestion and/or inhalation is respiratory failure.
2.Patients should be quickly evaluated for signs of respiratory distress (e.g. cyanosis, tachypnea, intercostal retraction, obtundation) and given oxygen. Patients with inadequate tidal volumes or poor arterial blood gases (pO_2 <50 mm Hg or pCO_2 >50 mm Hg) should be intubated.

3.Arrhythmias complicate some hydrocarbon ingestion and/or inhalation and electrocardiographic evidence of myocardial injury has been reported; intravenous lines and cardiac monitors should be established in obviously symptomatic patients. The lungs excrete inhaled solvents, so that hyperventilation improves clearance.
4.A chest x-ray should be taken immediately after stabilization of breathing and circulation to document aspiration and detect the presence of pneumothorax.
5.Epinephrine (adrenalin) is not recommended for treatment of bronchospasm because of potential myocardial sensitization to catecholamines.
Inhaled cardioselective bronchodilators (e.g. Alupent, Salbutamol) are the preferred agents, with aminophylline a second choice.
6.Lavage is indicated in patients who require decontamination; ensure use of cuffed endotracheal tube in adult patients.

Section 5 - Fire-Fighting Measures

Flash Point: -76.111 °C
Autoignition Temperature: 465 °C
LEL: 1.8% v/v
UEL: 9.6% v/v
Extinguishing Media: Water spray or fog; dry chemical powder.
Carbon dioxide.
Foam.
General Fire Hazards/Hazardous Combustion Products: Flammable gas. Liquid and vapor are highly flammable.
Dangerous hazard when exposed to heat, flame and oxidizers.
Gas may form explosive mixtures with air over a wide area.
Decomposes on heating and produces toxic fumes of carbon monoxide (CO) and carbon dioxide (CO_2).



Fire Diamond

Fire Incompatibility: Avoid contamination with oxidizing agents i.e. nitrates, oxidizing acids, chlorine bleaches, pool chlorine etc. as ignition may result.
Fire-Fighting Instructions: Contact fire department and tell them location and nature of hazard.
May be violently or explosively reactive. Wear full body protective clothing with breathing apparatus. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation.
Do not extinguish burning gas. If safe to do so, stop flow of gas.
If flow of gas cannot be stopped, leave gas to burn.
Cool fire-exposed containers with water spray from a protected location.
Do not approach cylinders suspected to be hot.
If safe to do so, remove containers from path of fire.
Fight fire from a safe distance, with adequate cover.

Section 6 - Accidental Release Measures

Small Spills: . Avoid breathing vapor and any contact with liquid or gas. Protective equipment including respirator should be used.
2. Do NOT enter confined spaces were gas may have accumulated.
3. Shut of all sources of possible ignition and increase ventilation.
4. Clear area of personnel.
5. Stop leak only if safe to so do.
6. Remove leaking cylinders to safe place. Release pressure under safe controlled conditions by opening valve.
7. Keep area clear of personnel until gas has dispersed.
Large Spills: DO NOT touch the spill material. Shut off all possible sources of ignition and increase ventilation.
Restrict access to area. Clear area of personnel and move upwind.
May be violently or explosively reactive. Wear full body protective clothing with breathing apparatus. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation.
Avoid spraying water onto liquid pools.
Use extreme caution to avoid a violent reaction.
Stop leak if safe to do so.
DO NOT enter confined places where gas may have collected. Remove leaking cylinders to a safe place. Fit vent pipes. Release pressure under safe, controlled conditions by opening valve. Burn issuing gas at vent pipes.
Do not exert excessive pressure on valve; do not attempt to operate damaged valve.
Keep area clear of personnel until gas has dispersed
Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Use good occupational work practices. Use in a well-ventilated area.
Obtain a work permit before attempting any repairs.
Do not attempt repair work on lines, vessels under pressure.

Atmospheres must be tested and O.K. before work resumes after leakage.
Wear protective clothing and gloves when handling containers.
No smoking, bare lights, heat or ignition sources.
Use spark-free tools when handling. Ground all lines and equipment.
Prevent concentration in hollows and sumps. DO NOT enter confined spaces until atmosphere has been checked.
Gas may travel a considerable distance to source of ignition.
Vapor may ignite on pumping or pouring due to static electricity.
Avoid physical damage to containers.
DO NOT transfer gas from one cylinder to another.
Natural gases contain a contaminant, radon-222, a naturally occurring radioactive gas. During subsequent processing, radon tends to concentrate in liquified petroleum streams and in product streams having similar boiling points.
Industry experience indicates that the commercial product may contain small amounts of radon-222 and its radioactive decay products (radon daughters). The actual concentration of radon-222 and radioactive daughters in process equipment (IE lines, filters, pumps and reactor units) may reach significant levels and produce potentially damaging levels of gamma radiation. A potential external radiation hazard exists at or near any pipe, valve or vessel containing a radon enriched stream or containing internal deposits of radioactive material. Field studies, however, have not shown that conditions exist that expose the worker to cumulative exposures in excess of general population limits. Equipment containing gamma-emitting decay products should be presumed to be internally contaminated with alpha- emitting decay products which may be hazardous if inhaled or ingested.
During maintenance operations that require the opening of contaminated process equipment, the flow of gas should be stopped and a four hour delay enforced to allow gamma-radiation to drop to background levels. Protective equipment (including high efficiency particulate respirators (P3) suitable for radionucleotides or supplied air) should be worn by personnel entering a vessel or working on contaminated process equipment to prevent skin contamination or inhalation of any residue containing alpha-radiation.
Airborne contamination may be minimized by handling scale and/or contaminated materials in a wet state.

Recommended Storage Methods: Packaging as recommended by manufacturer.
Check that containers are clearly labeled.
Cylinder fitted with valve protector cap.
Ensure the use of equipment rated for cylinder pressure.
Ensure the use of compatible materials of construction.
Cylinder valve must be closed when not in use or when empty.
Cylinder must be properly secured either in use or in storage.
WARNING: Suckback into cylinder may result in rupture.
Use back-flow preventive device in piping.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Use in a well-ventilated areaIf gas concentrations are high: or If risk of overexposure exists, wear NIOSH-approved respirator.
Correct fit is essential to obtain adequate protection.
Used in closed pressurized systems; fitted with temperature and pressure safety relief valves which are vented to allow safe dispersal.
Provide adequate ventilation in warehouse or closed storage areas.

Personal Protective Clothing/Equipment:

Eyes: Safety glasses with side shields; or as required, chemical goggles.
Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.

Hands/Feet: Protective gloves eg. leather gloves or gloves with leather facing. Neoprene rubber gloves.
Safety footwear.

Other: Operators should be trained in correct use & maintenance of respirators Ensure that there is ready access to breathing apparatus.
Protective overalls, closely fitted at neck and wrist. Eye-wash unit.
IN CONFINED SPACES:
1. Non-sparking protective boots.
2. Static-free clothing.
3. Ensure availability of lifeline.
Staff should be trained in all aspects of rescue work.
Ensure there is ready access to an emergency shower.

Section 9 - Physical and Chemical Properties

Appearance/General Info: Easily liquified flammable gas or colorless highly volatile liquid. Packed as liquid under pressure and remains liquid only under pressure. Sudden release of pressure or leakage may result in rapid vaporization with generation of large volume of highly flammable / explosive gas. Strong gasoline odor. Floats and boils on water giving a flammable / explosive, visible cloud. Soluble in alcohol, ether, benzene and sulphuric acid.

Physical State: Liquefied gas
Vapor Pressure (kPa): 182 kPa at 10 °C
Vapor Density (Air=1): 2.01
Formula Weight: 56.11
Specific Gravity (H_2O=1, at 4 °C): 0.59
Evaporation Rate: Very rapid
pH: Not applicable
pH (1% Solution): Not applicable.
Boiling Point: -6.9 °C (20 °F)
Freezing/Melting Point: -140.35 °C (-220.63 °F)
Volatile Component (% Vol): 100
Water Solubility: Practically insoluble in water

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Product is considered stable. Hazardous polymerization will not occur.
Storage Incompatibilities: Avoid contact with oxidizing agents.
The interaction of alkenes and alkynes with nitrogen oxides and oxygen may produce explosive addition products; these may form at very low temperatures and explode on heating to higher temperatures (the addition products from 1,3-butadiene and cyclopentadiene form rapidly at -150 °C and ignite or explode on warming to -35 to -15 C). These derivatives ("pseudo- nitrosites") were formerly used to characterize terpene hydrocarbons.
Exposure to air must be kept to a minimum so as to limit the build-up of peroxides which will concentrate in bottoms if the product is distilled.
The product must not be distilled to dryness if the peroxide concentration is substantially above 10 ppm (as active oxygen) since explosive decomposition may occur. Distillate must be immediately inhibited to prevent peroxide formation. The effectiveness of the antioxidant is limited once the peroxide levels exceed 10 ppm as active oxygen. Addition of more inhibitor at this point is generally ineffective.
Prior to distillation it is recommended that the product should be washed with aqueous ferrous ammonium sulfate to destroy peroxides; the washed product should be immediately re-inhibited.
A range of exothermic decomposition energies for double bonds is given as 40-90 kJ/mol. The relationship between energy of decomposition and processing hazards has been the subject of discussion; it is suggested that values of energy released per unit of mass, rather than on a molar basis (J/g) be used in the assessment. For example, in "open vessel processes" (with man-hole size openings, in an industrial setting), substances with exothermic decomposition energies below 500 J/g are unlikely to present a danger, whilst those in "closed vessel processes" (opening is a safety valve or bursting disk) present some danger where the decomposition energy exceeds 150 J/g.
Avoid reactions with oxidizing agents, organic acids, inorganic acids halogenated compounds, polymerizable esters, oxygen, cyanohydrins and molten sulphur.

Section 11 - Toxicological Information

Toxicity
Inhalation (rat) LC_{50}: 620000 mg/m^3/4h

Irritation
Nil reported

See NIOSH, *RTECS* UD 0890000, for additional data.

Section 12 - Ecological Information

Environmental Fate: No data found.
Ecotoxicity: No data found.
BCF: no food chain concentration potential
Biochemical Oxygen Demand (BOD): none

Section 13 - Disposal Considerations

Disposal: Consult manufacturer for recycling options.
Discharge to burning flare. Return empty cylinders to supplier.

Section 14 - Transport Information

DOT Transportation Data (49 CFR 172.101):

Shipping Name: ISOBUTYLENE
Additional Shipping Information: ISOBUTENE
Hazard Class: 2.1
ID No.: 1055
Packing Group: None
Label: Flammable Gas[2]

Section 15 - Regulatory Information

EPA Regulations:

RCRA 40 CFR: Not listed
CERCLA 40 CFR 302.4: Not listed
SARA 40 CFR 372.65: Not listed
SARA EHS 40 CFR 355: Not listed
TSCA: Listed

Section 16 - Other Information

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Group, Inc. extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

APPENDIX B

ACCIDENT REPORTING FORM

TRC ACCIDENT REPORTING FORM

Field Personnel		Job Name and No.	
Date & Time		Location	
Tasks performed		Witnesses	
Resulted in	__ Injury __ Fatality __ Property Damage	Property Damage	
Injured Person		Weather Conditions	
Describe Accident Facts & Events			

Supervisor's Root Cause Analysis Check ALL that apply to this accident

Unsafe Acts		**Unsafe Conditions**	
Improper work technique		Poor Workstation design	
Safety rule violation		Unsafe Operation Method	
Improper PPE or PPE not used		Improper Maintenance	
Operating without authority		Lack of direct supervision	
Failure to warn or secure		Insufficient Training	
Operating at improper speeds		Lack of experience	
By-passing safety devices		Insufficient knowledge of job	
Protective equipment not in use		Slippery conditions	
Improper loading or placement		Excessive noise	
Improper lifting		Inadequate guarding of hazards	
Servicing machinery in motion		Defective tools/equipment	
Horseplay		Poor housekeeping	
Drug or alcohol use		Insufficient lighting	

Unsafe Acts require a written warning and re-training before the Employee resumes work

Accident Report Review

Employee Signature _____ Date _____

Sr. Project Manager _____ Date _____

Health & Safety Officer _____ Date _____

- Find the cause to prevent future accidents - use an unbiased approach during investigation
- Interview witnesses & injured employees at the scene - conduct a walkthrough
- Conduct interviews in private - interview one witness at a time.
- Get signed statements from all involved.
- Take photos or make a sketch of the accident scene.
- What hazards are present - what unsafe acts contributed to accident
- Ensure hazardous conditions are corrected immediately.

APPENDIX B

NJDEP AIR PERMIT

State of New Jersey
CHRIS CHRISTIE
Governor
KIM GUADAGNO
Lt. Governor
DEPARTMENT of ENVIRONMENTAL PROTECTION
Division of Air Quality
Bureau of Air Permits
401 E. State Street, 2nd floor, P.O. Box 420, Mail Code 401-02
Trenton, NJ 08625-0420
BOB MARTIN
Commissioner

Air Pollution Control
Preconstruction Permit and Certificate to Operate
Construction of a New Source

Permit Activity Number: PCP120001 **Program Interest No: 26792**

Mailing Address	Plant Location
DANIEL KLOCKNER III MGR KLOCKNER & KLOCKNER PO BOX 343 Blairstown, NJ 07825	KLOCKNER & KLOCKNER 10 Stickle Ave Rockaway Boro Morris County, New Jersey

Approval Date: 01/14/2013
Expiration Date: 01/13/2018

The New Jersey Department of Environmental Protection (Department) has reviewed the above referenced air pollution control permit application. On the basis of the information provided, the Department concludes that the application satisfies all applicable requirements of the New Jersey Air Pollution Control regulations codified at N.J.A.C. 7:27 et seq. This permit allows for inspection and evaluation of the equipment by the Department to assure conformance with all provisions of N.J.A.C. 7:27 et seq. and any other applicable federal requirements codified at 40 CFR 52, 60, 61 and 63.

The equipment, that is authorized to be installed and operated under this approval, is described in Section A, Source Operations and Section D, Equipment Inventory. Equipment at the facility referenced by this Permit shall be operated in accordance with the Conditions of Approval set forth in Section D, Facility Specific Requirements.

The Department hereby issues this permit and certificate under the authority of chapter 106, P.L. 1967(N.J.S.A 26:2C-9.2). You may construct, reconstruct, install, or modify the above referenced equipment and/or control apparatus consistent with the approval.

The approved Permit is available for download in PDF format which contains the facility's specific requirements (compliance plan) at: http://www.nj.gov/dep/aqpp. After accessing the web site, click on "Approved PCP Permits" listed under "Reports" and then type in your Program Interest (PI) Number, 26792, as instructed on the screen. You will be able to view, print or electronically store your permit. If you have any questions regarding this permit approval, please contact the Department at the Preconstruction Permit Help Line available from

9:00 AM to 4:00 PM daily, where you may speak to someone about any technical questions you may have. The Preconstruction Permit Technical Help Line number is 609-292-6716.

If, in your judgment as an applicant for an air pollution control permit, the Department is imposing any unreasonable Condition of Approval, you may contest the Department's decision and request a contested case hearing pursuant to the Administrative Code at N.J.A.C. 7:27-1.32(a). All requests for contested case hearings must be received in writing by the Department within twenty (20) calendar days of the date you receive this permit approval and must contain the information specified in the Administrative Hearing Request Checklist and Tracking Form.

If you have any non technical questions please use the Bureau's number 609- 292-0834. If you have any questions when filing a General Permit please use the General Permit Help number 609-633-2829.

Approved by:

William Kuehne
Environmental Engineer 4 (Supervisor)
Preconstruction Permits

Administrative Hearing Request Checklist and Tracking Form

I. Document Being Appealed

Name of the Facility	Facility ID Number	Permit Activity Number	Issuance Date
KLOCKNER & KLOCKNER	26792	PCP120001	

II. Contact Information

Name of Person Requesting Hearing	Name of Attorney (if applicable)
Address:	**Address:**
Telephone:	**Telephone:**

III. Please include the following information as part of your request:

A. The date the permittee received the permit decision;
B. Two printed copies of the document being appealed – for submitting to address 1 below;
A PDF copy of the document being appealed on a CD – for submitting to address 2 below
C. The legal and factual questions you are appealing;
D. A statement as to whether or not you raised each legal and factual issues during the permit application process;
E. Suggested revised or alternative permit conditions;
F. An estimate of the time required for the hearing;
G. A request, if necessary, for a barrier-free hearing location for physically disabled persons;
H. A clear indication of any willingness to negotiate a settlement with the Department prior to the Departments processing of your hearing request to the Office of Administrative Law;

Mail this form, completed, signed and dated with all of the information listed above, including attachment, to:

1. New Jersey Department of Environmental Protection
Office of Legal Affairs
Attention: Adjudicatory Hearing Requests
401 E. State Street, P.O. Box 402
Trenton, New Jersey 08625

2. Air Quality Permitting Element
Preconstruction Permits
New Jersey Department of Environmental Protection
401 E. State Street, 2nd Floor, P.O. Box 027
Trenton, New Jersey 08625
Phone: (609) 633-2829

Signature **Date**

Administrative Hearing Request Checklist and Tracking Form

IV. If you are not the applicant but rather an interested person claiming to be aggrieved by the permit decision, please include the following information:

1. The date you or your agent received notice of the permit decision (include a copy of that permit decision with your hearing request);
2. Evidence that a copy of the request has been delivered to the applicant for the permit which is the subject of the permit decision;
3. A detailed statement of which findings of fact and/or conclusion of law you are challenging;
4. A description of your participation in any public hearings held in connection with the permit application and copies of any written comments you submitted;
5. Whether you claim a statutory or constitutional right to a hearing, and, if you claim such a right, a reference to the applicable statute or explanation of how your property interests are affected by the permit decision;
6. If the appeal request concerns a CAFRA permit decision, evidence that a copy of the request has been delivered to the clerks of the county and the municipality in which the project which is the subject of the permit decision is located;
7. Suggested revised or alternative permit conditions;
8. An estimate of the time required for the hearing;
9. A request, if necessary, for a barrier-free hearing location for physically disable persons;
10. A clear indication of any willingness to negotiate a settlement with the Department prior to the Department's transmittal of the hearing request to the Office of Administrative Law;

Mail this form, completed, signed and dated with all of the information listed above, including attachment, to:

New Jersey Department of Environmental Protection
Office of Legal Affairs
Attention: Adjudicatory Hearing Requests
401 East State Street, P.O. Box 402
Trenton, New Jersey 08625-0402

Air Quality Permitting Element
Preconstruction Permits
New Jersey Department of Environmental Protection
401 E. State Street, 2nd Floor, P.O. Box 027
Trenton, New Jersey 08625
Phone: (609) 633-2829

Signature **Date**

AIR POLLUTION CONTROL PRECONSTRUCTION PERMIT EQUIVALENCY

Table of Contents

Facility Name: KLOCKNER & KLOCKNER
Facility ID No.: 26792
Permit Activity No.: PCP120001

AIR POLLUTION CONTROL PRECONSTRUCTION PERMIT EQUIVALENCY

Section A

Facility Name: KLOCKNER & KLOCKNER
Facility ID No.: 26792
Permit Activity No.: PCP120001

AUTHORIZED SOURCE OPERATIONS

This Preconstruction Permit and the Certificate to Operate for the following equipment is issued pursuant to N.J.A.C. 7:27-8.

Description of Source Activity

Source Operation Type: Soil vapor extraction (SVE) implemented at the Klockner & Klockner Source Area (OU3) of the Rockaway Borough Well Field **SUPERFUND** Site located in Rockaway, Morris County, New Jersey.

Source Operation Description: The SVE system consists of twelve (12) SVE wells and a horizontal trench from which vapor exhausts are treated through two (2) granular activated carbon (GAC) beds before being released into the atmosphere.

Source Operation Details: The sources authorized by this permit shall be operated within the parameters specified in the Equipment, Control Device, and/or Emission Unit/Batch Process Operating Scenario Details of this permit. Operation of the authorized sources within these parameters is required in addition to compliance with the conditions specified in Section D– Facility Specific Requirements.

AIR POLLUTION CONTROL PRECONSTRUCTION PERMIT EQUIVALENCY

Section B

Facility Name: KLOCKNER & KLOCKNER
Facility ID No.: 26792
Permit Activity No.: PCP120001

ACRONYMS

BTS	Bureau of Technical Services
CEMS	Continuous Emissions Monitor System
CFR	Code of Federal Regulations
CO	Carbon Monoxide
COMS	Continuous Opacity Monitor System
EPA	United States Environmental Protection Agency
HAP	Hazardous Air Pollutant
N.J.A.C.	New Jersey Administrative Code
NJDEP	New Jersey Department of Environmental Protection
NOx	Oxides of Nitrogen
PM-2.5	All particulate matter having an aerodynamic diameter less than or equal to a nominal 2.5 microns
PM-10	All particulate matter having an aerodynamic diameter less than or equal to a nominal 10 microns
PST	Performance Specification Test
REO	Regional Enforcement Office - NJDEP
SO_2	Sulfur Dioxide
TSP	Total Suspended Particulate Matter
VOC	Volatile Organic Compounds

AIR POLLUTION CONTROL PRECONSTRUCTION PERMIT EQUIVALENCY

Section C

Facility Name: KLOCKNER & KLOCKNER
Facility ID No.: 26792
Permit Activity No.: PCP120001

GENERAL PROVISIONS AND AUTHORITIES
Preconstruction Permits

1. Not withstanding compliance with other provisions of N.J.A.C. 7:27-1 et seq., no person shall cause, suffer, allow or permit to be emitted into the outdoor atmosphere substances in quantities which shall result in air pollution as defined at N.J.A.C. 7:27-5.1. [N.J.A.C. 7:27-5.2(a)]

2. The permittee shall not construct, reconstruct, install, or modify a significant source or control apparatus serving the significant source without first obtaining a preconstruction permit under N.J.A.C. 7:27-8. [N.J.A.C. 7:27-8.3(a)]

3. The permittee shall not operate (nor cause to be operated) a significant source or control apparatus serving the significant source without a valid operating certificate. [N.J.A.C. 7:27-8.3(b)]

4. Permit Revisions:

   The permittee shall not take any action which requires a permit revision, compliance plan change, seven-day-notice change, amendment, or change to a batch plant permit, under any applicable provision at N.J.A.C. 7:27-8.17 through 8.23, without complying with that applicable provision.

   The following summarize N.J.A.C. 7:27-8.18 through 8.21:

   a. The permittee shall file a permit revision request and receive approval from the Department prior to increasing any maximum allowable emission limit, increasing actual emissions, to a rate or concentration greater than a maximum allowable emission, causing the emissions of a new air contaminant, use a new raw material, reconstructing equipment, change the ground level concentration of an air contaminant in an area where the public has access, replace the permitted source, or constructing or installing a new significant source. [N.J.A.C. 7:27-8.18]

   b. The permittee shall file a compliance plan change request and receive approval from the Department prior to decreasing the frequency of testing, monitoring, recordkeeping, or reporting, changing the monitoring method, changing a level, rate, or limit of an operational parameter included in the conditions, or reducing a source's potential to emit. [N.J.A.C. 7:27-8.19]

   c. At least seven days prior to proceeding with a physical or operational change that is outside the scope of activities allowed by this permit, but will not increase emissions over the allowable emissions and will not alter the stack characteristics, the permittee shall file a seven-day-notice change. The permittee may proceed with the proposed changes seven days after such notice is filed with the Department. [N.J.A.C. 7:27-8.20]

d. The permittee shall file an amendment within 120 days of making any change of the information contained within Section C of this permit (Facility Profile), changing the name, number or designation of any equipment or stack covered by this permit, changing the parameters of a stack in such a way to reduce the ground level concentration of an air contaminant, or correction of a typographical error that will not result in an increase of actual or allowable emissions. [N.J.A.C. 7:27-8.21]

The permittee shall review the provisions of N.J.A.C. 7:27-8.18 through 7:27-8.21 to determine the appropriate type of request to file.

5. The permittee shall make the preconstruction permit or certificate, together with any amendments, seven-day-notices, or other documents related to the permit and certificate, readily available for Department inspection on the operating premises. [N.J.A.C. 7:27-8.3(d)]

6. The permittee shall not use or cause to be used the equipment or control apparatus unless all components connected or attached to, or serving, the equipment or control apparatus, are functioning properly and are in compliance with the preconstruction permit and certificate and all conditions and provisions thereto. [N.J.A.C. 7:27-8.3(e)]

7. A preconstruction permit is not transferable either from the location authorized in the preconstruction permit to another location, or from any one piece of control apparatus or equipment to another piece of control apparatus or equipment. [N.J.A.C. 7:27-8.3(f)]

8. Once a permit or certificate is issued, the permittee is fully responsible for compliance with N.J.A.C. 8:27-8 and with the permit and certificate, including adequate design, construction, and operation of the source, even if employees, contractors, or others work on or operate the permitted source. If the Department issues any other requirement with the force of law, such as an order, which applies to the source, the permittee is also responsible for compliance with that requirement. [N.J.A.C. 7:27-8.3(g)]

9. Preconstruction permits and certificates do not any way relieve the permittee from the obligation to obtain necessary permits from other government agencies and to comply with all other applicable Federal, State, and local rules and regulations. [N.J.A.C. 7:27-8.3(h)]

10. The permittee shall not suffer, allow, or permit any air contaminant detectable by the sense of smell, to be present in the outdoor atmosphere in such quantity and duration which is, or tends to be, injurious to human health or welfare, animal or plant life or property, or would unreasonably interfere with the enjoyment of life or property. This shall not include an air contaminant which occurs only in areas over which the permittee has exclusive use or occupancy. In determining whether an odor unreasonably interferes with the enjoyment of life or property, the Department shall consider all of the relevant facts and circumstances, including, but not limited to, the character, severity, frequency, and duration of the odor, and the number of persons affected thereby. In considering these and other relevant facts and circumstances, no one factor shall be dispositive, but each shall be considered relevant in determining whether an odor interferes with the enjoyment of life or property, and, if so, whether such interference is unreasonable considering all of the circumstances. [N.J.A.C.7:27-8.3(j)]

11. The Department and its representatives have the right to enter and inspect any facility or property in accordance with N.J.A.C. 7:27-1.31. [N.J.A.C. 7:27-8.3(m)]

12. There shall be an affirmative defense to liability for penalties for a violation of a preconstruction permit or certificate occurring as a result of an equipment malfunction, an equipment start-up, an equipment shutdown, or during the performance of necessary maintenance. The affirmative defense shall be asserted and established as required pursuant to P.L. 1993. c.89 (adding N.J.S.A. 26:2C-19.1 through 2C-19.5) and any rules the Department promulgates thereunder, and shall meet all of the requirements thereof. There shall also be an affirmative defense to liabilities for penalties or other sanctions for noncompliance with any technology based emission limitation in this permit or certificate, if the noncompliance was due to an emergency as defined at N.J.A.C. 7:27-22.1, provided that the affirmative defense is asserted and established in compliance with 40 CFR 70.6(g) and meets all requirements thereof. [N.J.A.C. 7:27-8.3(n)]

13. The permittee shall not cause or use the equipment specified in a preconstruction permit in a manner that will result in the emission of any air contaminant not listed in the Facility Specific Requirements in this Preconstruction Permit at a rate equal to or higher than the applicable reporting threshold set forth at N.J.A.C. 7:27-8 Appendix I, Table A or B. [N.J.A.C. 7:27-8.4(k)1]

14. No air contaminant, or category of air contaminant, where accepted by the Department, shall be emitted other than those approved in the preconstruction permit. [N.J.A.C. 7:27-8.13(a)]

15. Any person to whom the Department has issued a preconstruction permit or certificate shall comply with all terms and conditions of any order related to the preconstruction permit or certificate. [N.J.A.C. 7:27-8.13(a)]

16. The permittee shall maintain all records required in the preconstruction permit for a period of five (5) calendar years from the calendar year within which the record was generated. [N.J.A.C. 7:27-8.13(a)]

17. The Department may change the conditions of approval of any approved certificate to operate at the time of renewal of a temporary operating certificate; at the time of approval or renewal of a five-year operating certificate; or at any time during the period a certificate is in effect, if the Department determines that such change is necessary to protect human health or welfare or the environment. [N.J.A.C. 7:27-8.13(b)]

18. Upon request of the Department, the permittee shall submit to the Department information relevant to the operation of equipment and control apparatus including all information specified at N.J.A.C. 7:27-8.13(c). [N.J.A.C. 7:27-8.13(c)]

19. If the conditions of a preconstruction permit or certificate to operate require the Department to incur any of the following charges, the permittee shall reimburse the Department for the full amount of these charges: (1) The charges billed by any phone company for the maintenance of a dedicated telephone line required by this permit or the certificate to operate for the electronic transmission of data; or (2) The charges billed by any laboratory for performing the analysis of audit samples collected pursuant to testing or monitoring required by this permit or the certificate to operate. [N.J.A.C. 7:27-8.13(g)]

20. Any exceedance of the operating requirements or emission concentrations specified in a preconstruction permit shall be reported within three (3) business days, by writing to the Regional Enforcement Office. [N.J.A.C. 7:27-8.13(h)]

21. The permittee shall, when requested by the Department, provide such testing facilities exclusive of instrumentation and sensing devices as may be necessary for the Department to determine the kind and amount of air contaminants emitted from the equipment or control apparatus. The testing facilities shall include the utilities, the structure to hold testing equipment and/or personnel, and any ports in stacks needed to carry out testing required by this permit. During testing by the Department, the equipment and control apparatus shall be operated under such conditions within their capacities as may be requested by the Department. The test facilities may be either permanent or temporary, at the discretion of the person responsible for their provision, and shall conform to all applicable laws, regulations, and rules concerning safe construction and safe practice. Testing facilities, which contain platforms and other means of personnel access, shall conform to OSHA standards. [N.J.A.C. 7:27-8.13(i)]

22. Upon request of the Department, the permittee shall submit to the Department any record relevant to any permit or certificate. Such records shall be submitted to the Department within thirty (30) days of the request by the Department or within a longer time period if approved in writing by the Department. [N.J.A.C. 7:27-8.15(a)]

23. The permittee shall submit any required report in a format and on a schedule approved by the Department. Such report shall be transmitted on paper, on computer disk, or electronically, at the discretion of the Department. [N.J.A.C. 7:27-8.15(b)]

24. Any report submitted to the Department, including but not limited to, a report submitted as an amendment of this permit or the certificate to operate pursuant to N.J.A.C. 7:27-8.3(c) shall include, as an integral part of the report, certifications complying with N.J.A.C. 7:27-1.39. [N.J.A.C. 7:27-8.15(c)]

25. Upon request of the Department, the permittee shall report on forms obtained from the Department the air contaminant actual emissions and information relevant thereto, of any air contaminant or category of air contaminant emitted by the equipment, control apparatus, or source operation. [N.J.A.C. 7:27-8.15(d)]

26. Any emission limit values in a preconstruction permit shall be interpreted to be followed by inherent trailing zeros (0) in the decimal portion of the limit to three significant figures (e.g. a printed limit of “1 lb/hr” means a limit of “1.00 lb/hr”).

27. This listing of requirements reflects the state rules and regulations that apply to a majority of sources. If a specific requirement in a rule or regulation that applies to a permittee is not included in this section or in the Facility Specific Requirements it does not relieve the permittee from the obligation to comply with that regulation.

28. Process monitors must be operated at all times when the associated process equipment is operating except during outage time allowed by Department guidelines/procedures or as outlined in Technical Manual 1005. The Permittee must keep a service log as required.

29. The following Department offices may be referenced in a preconstruction permit. Please use the following addresses when submitting any correspondence to these offices:

Bureau of Technical Services
P. O. Box 437
380 Scotch Road
West Trenton, NJ 08625

Central Regional Enforcement Office
P. O. Box 407
Trenton, NJ 08625-0407

Northern Regional Enforcement Office
7 Ridgedale Avenue
Cedar Knolls, NJ 07927

Southern Regional Enforcement Office
2 Riverside Drive – Suite 201
Camden, NJ 08102

30. In accordance with the Air Pollution Control Act at N.J.S.A. 26:2C-19(e), any operation of the equipment which may cause off-property effect, including odors, shall be immediately reported by calling the NJDEP Environmental Action Hotline at (877) 927-6337.

31. In accordance with N.J.A.C. 7:27-21, facilities are required to submit annual emission statements of their actual emissions if the Potential-to-emit for the entire facility exceeds the following thresholds (including all emissions from the facility, both permitted and unpermitted). Additional information about Emission Statement reports can be obtained by calling (609) 984-5483.

AIR CONTAMINANT	**Threshold in Tons per Year**
VOC (Volatile Organic Compounds	10
NOx (Oxides of Nitrogen)	25
CO (Carbon Monoxide)	100
SO_2 (Sulfur Dioxide)	100
TSP (Total Suspended Particulates)	100
$PM_{2.5}$ (Particulate Matter $\leq$ 2.5 microns)	100
PM_{10} (Particulate Matter $\leq$ 10 microns)	100
NH_3 (Ammonia)	100
Lead	5

32. In accordance with N.J.A.C. 7:27-22, facilities are required to submit a Title V Operating Permit application, within one year, if the potential-to-emit for the entire facility exceeds any of the following thresholds (including all emissions from the facility, both permitted and unpermitted). Additional Information about Operating Permits can be obtained by calling the Operating Permit Hotline at (609) 633-8248.

AIR CONTAMINANT	**Threshold in Tons per Year**
VOC (Volatile Organic Compounds)	25
NOx (Oxides of Nitrogen)	25
CO (Carbon Monoxide)	100
SO_2 (Sulfur Dioxide)	100
TSP (Total Suspended Particulates)	100
PM_{10} (Particulate Matter $\leq$ 10 microns)	100
Lead	10
Any HAP (Hazardous Air Pollutant)	10
All HAPs Collectively	25
Any other Air Contaminant	100

AIR POLLUTION CONTROL PRECONSTRUCTION PERMIT EQUIVALENCY

Section D

Facility Name: KLOCKNER & KLOCKNER
Facility ID No.: 26792
Permit Activity No.: PCP120001

PERMIT INFORMATION

FACILITY SPECIFIC REQUIREMENTS INDEX

FACILITY SPECIFIC REQUIREMENTS

REASON FOR APPLICATION

FACILITY PROFILE (GENERAL)

EQUIPMENT INVENTORY

CONTROL DEVICE INVENTORY

EMISSION POINT INVENTORY

EMISSION UNIT/BATCH PROCESS INVENTORY

AIR POLLUTION CONTROL PRECONSTRUCTION PERMIT EQUIVALENCY

Section D

Facility Name: KLOCKNER & KLOCKNER
Facility ID No.: 26792
Permit Activity No.: PCP120001

FACILITY SPECIFIC REQUIREMENTS INDEX

New Jersey Department of Environmental Protection
Facility Specific Requirements

Emission Unit: **U1 SVE Full Scale System**
CD1 GAC-1, CD2 GAC-2

Subject Item:

Ref.#	Applicable Requirement	Monitoring Requirement	Recordkeeping Requirement	Submittal/Action Requirement
1	Consists of at least two (2) 1000 pounds of vapor phase granular activated carbon (GAC) per column installed in series. [N.J.A.C. 7:27- 8]	Monitored by documentation of construction once initially : Carbon column manufacturer/vendor specifications. [N.J.A.C. 7:27- 8]	Recordkeeping by manual logging of parameter or storing data in a computer data system once initially. All documentation records shall be kept on-site or at the permittee's main office for at least five (5) years, readily made available to the Department or its representatives upon request. [N.J.A.C. 7:27- 8]	None.
2	Total GAC removal efficiency of VOC (Total) >= 99 %. [N.J.A.C. 7:27- 8]	VOC (Total): Monitored by documentation of construction once initially : GAC column manufacturer 's VOC (total) emissions performance guarantee data. [N.J.A.C. 7:27- 8]	VOC (Total): Recordkeeping by manual logging of parameter or storing data in a computer data system once initially. All documentation of construction shall be kept on-site or at the permittee's main offices, for at least five (5) years, readily made available to the Department or its representatives upon request. [N.J.A.C. 7:27- 8]	None.
3	VOC (Total) <= 50 ppmv as Isobutylene. At all times while operating, breakthrough shall be defined as this specified concentration measured between the two (2) GAC units. [N.J.A.C. 7:27- 8.13(h)1]	VOC (Total): Monitored by periodic emission monitoring at the approved frequency, based on 3 minute intervals using a PID/FID or equal monitoring device as follow: Daily during the 1st week of the SVE system install- then weekly within first month of operation and monthly thereafter. [N.J.A.C. 7:27- 8.13(d)1]	VOC (Total): Recordkeeping by manual logging of parameter or storing data in a computer data system at the approved frequency :Daily during the 1st week of the SVE system install- then weekly within first month of operation and monthly thereafter. All monitoring results shall include the following: 1. Date of meter reading, 2. GAC column designation, 3. Effluent gas throughput {scfm}, 4. VOC meter reading {ppmv as isobutylene} and 5. Corresponding VOC (total) mass emission rate {lb/hour} prior to or at breakthrough. All monitoring records shall be kept on-site or at the permittee's main office for a minimum of 5 years and made available to the Department or its representatives upon request. [N.J.A.C. 7:27- 8.13(d)3]	None.

New Jersey Department of Environmental Protection
Facility Specific Requirements

Ref.#	Applicable Requirement	Monitoring Requirement	Recordkeeping Requirement	Submittal/Action Requirement
4	Prior to or at breakthrough, the facility shall replace the spent GAC with a "new" or "regenerated" unit. [N.J.A.C. 7:27- 8]	None.	Recordkeeping by manual logging of parameter or storing data in a computer data system upon occurrence of event. The permittee shall record the following: 1. The date, time and designation of replaced and "new"or "regenerated" carbon column, 2. VOC (total) concentration {ppmv as isobutylene} and 3. VOC (total) mass emission rate {lb/hr}, prior to or at breakthrough, in a bound logbook or in computer memories. All records shall be kept on-site or at the permittee's main office for at least five (5) years, readily made available to the Department or its representatives upon request. [N.J.A.C. 7:27- 8]	None.
5	VOC (Total) <= 20 ppmv as isobutylene measured in the effluent gas (downstream from CD2). [N.J.A.C. 7:27- 8.13(h)1]	VOC (Total): Monitored by periodic emission monitoring at the approved frequency, based on 3 minute intervals using a PID/FID or equal monitoring device as follow: Daily during the 1st week of the SVE system install- then weekly within first month of operation and monthly thereafter. The Department reserves the right to change the frequency of periodic emission monitoring based on a review of the VOC (total) periodic emission monitoring data results. [N.J.A.C. 7:27- 8.13(d)1]	VOC (Total): Recordkeeping by manual logging of parameter or storing data in a computer data system each week during operation. All monitoring results shall include the following: 1. Date of meter reading; 2. GAC designation; 3. Effluent gas throughput {scfm}; 4. VOC meter reading {ppmv as isobutylene} and 5. VOC (total) mass emission rate {lb/hour}. All monitoring records shall be kept on-site or at the permittee's main office for a minimum of 5 years and made available to the Department or its representatives upon request. [N.J.A.C. 7:27- 8.13(d)3]	None.

New Jersey Department of Environmental Protection
Facility Specific Requirements

Ref.#	Applicable Requirement	Monitoring Requirement	Recordkeeping Requirement	Submittal/Action Requirement
6	At breakthrough, the facility shall replace CD1 with CD2 or a "new"/freshly regenerated carbon column. In addition, a "new"/freshly regenerated carbon column shall replace CD2 at the latest one (1) operating week from the date of initial breakthrough. Saturated or partially used adsorption material shall be disposed of in a manner that minimizes releases of air contaminants to the atmosphere. This shall be done in accordance with all applicable State and Federal Solid Waste Management Regulations. [N.J.A.C. 7:27- 8]	None.	Recordkeeping by manual logging of parameter or storing data in a computer data system upon occurrence of event. The permittee shall record the following: 1. Date, time and designation of "new" and replaced carbon columns, 2. VOC (total) breakthrough concentration and 3. Equivalent exhaust VOC (total) pounds per hour at breakthrough, in a bound logbook or in computer memories. All records shall be kept on-site or at the permittee's main office for at least five (5) years, readily made available to the Department or its representatives upon request. [N.J.A.C. 7:27- 8]	None.

New Jersey Department of Environmental Protection
Facility Specific Requirements

Emission Unit: **U1 SVE Full Scale System**
E1 SVE Blower

Subject Item:

Ref.#	Applicable Requirement	Monitoring Requirement	Recordkeeping Requirement	Submittal/Action Requirement
1	The SVE blower shall be operating fully on electrical power from the grid. [N.J.A.C. 7:27- 8]	Monitored by visual determination upon occurrence of event. [N.J.A.C. 7:27- 8]	None.	None.
2	The soil vapor extraction header pipe shall be sealed and directed through the soil vapor extraction blower E1 to the two (2) granular activated carbon columns CD1 and CD2 installed in series. [N.J.A.C. 7:27- 8]	Monitored by visual determination upon occurrence of event. [N.J.A.C. 7:27- 8]	None.	None.
3	Blower Extraction Rate <= 312 Cubic feet per minute. The maximum extraction rate of the blower shall be restricted using the full capacity of the blower at maximum design load or RPM and pressure drop, respectively. [N.J.A.C. 7:27- 8.13(d)2ii]	Blower Extraction Rate: Monitored by flue gas flow rate instrument continuously or equipment settings per equipment manufacturer O&M manual specifying blower maximum extraction rate at maximum full design load or RPM and pressure drop, respectively, and ambient air operating conditions. The Permittee shall install, calibrate and maintain the monitors in accordance with the manufacturer?s specifications. [N.J.A.C. 7:27- 8]	Blower Extraction Rate: Recordkeeping by manual logging of parameter or storing data in a computer data system once initially. The specification and operating performance curves of the soil vapor extraction blower including its maximum throughput shall be kept on-site or at the permittee's main office for at least five (5) years, readily made available to the Department or its representatives upon request. [N.J.A.C. 7:27- 8.13(d)3]	None.

New Jersey Department of Environmental Protection
Facility Specific Requirements

Emission Unit: **U1 SVE Full Scale System**

Operating Scenario: **OS Summary**

Ref.#	Applicable Requirement	Monitoring Requirement	Recordkeeping Requirement	Submittal/Action Requirement
1	The soil vapor extraction (SVE) is implemented at the Klockner & Klockner Source Area (OU3) of the Rockaway Borough Well Field Superfund Site located in Rockaway, N.J. The full scale SVE system incorporates 12 SVE wells and one (1) horizontal trench VET-1. [N.J.A.C. 7:27- 8]	None.	None.	None.

New Jersey Department of Environmental Protection
Facility Specific Requirements

Ref.#	Applicable Requirement	Monitoring Requirement	Recordkeeping Requirement	Submittal/Action Requirement
2	Opacity: There shall be no visible emissions from any of the twelve (12) SVE wells, the horizontal trench, SVE blower (E1) and the stack (PT1) exclusive of condensed water vapor, except for a period of not longer than three (3) minutes in any consecutive thirty (30) minute period. No visible emissions are equivalent to less than five percent (5%) opacity as determined using New Jersey Air Test Method 2 [N.J.A.C. 7:27-6.2(d)] and [N.J.A.C. 7:27- 6.2(e)]	Opacity: Monitored by visual determination upon occurrence of event, based on an instantaneous determination. For compliance with the opacity standard, the permittee, upon request of the Department or when emissions are observed above the allowable limits, shall conduct visual opacity inspections during daylight hours. Visual inspections shall consist of a visual survey to identify if the soil vapor extraction from any of the twelve (12) SVE, horizontal trench, SVE blower (E1) and the stack (PT1) produces visible emissions, (other than condensed water vapor), greater than the prescribed standard. If visible emissions are observed, the permittee shall do the following: (1) Verify that soil vapor extraction from the well and/or the horizontal trench that is causing visible emission is performed in accordance with the permit compliance plan and all applicable conditions of this approval. If not, the permittee shall take corrective action immediately to eliminate excess visible emissions. The permitee must report any permit violations to the Department. (2) If the corrective action taken in Step (1) does not correct the opacity problem within 24 hours, the permittee shall perform a check via a certified opacity reader, in accordance with New Jersey Air Test Method 2. Such test shall be conducted each day until corrective action successfully corrects the opacity problem. [N.J.A.C. 7:27- 8.13(d)]	Opacity: Recordkeeping by manual logging of parameter or storing data in a computer data system upon occurrence of event. The permittee shall record the following: (1) Date and time of opacity inspection; (2) Location(s) of visible emission points; (3) Soil vapor extraction status inside the cluster well(s); (4) Observed results and conclusions; (5) Description of corrective action taken, if needed; (6) Date and time opacity problem was solved, if applicable; (7) New Jersey Test Method 2 results, if conducted; and (8) Name of person(s) conducting the inspection. All records shall be kept on-site or at the permittee's main office for at least five (5) years, readily made available to the Department or its representatives upon request. [N.J.A.C. 7:27- 8.13(d)]	Submit a report: Upon occurrence of event over the allowable amount: The Permittee shall immediately take corrective measures to prevent visible emissions. If these measures fail, within 24-hours of observation, the permittee shall report the incident time and date of occurrence, source or location of visible emissions and control measures taken in writing to the NJDEP Northern Regional Enforcement Office within three (3) working days from occurrence. [N.J.A.C. 7:27- 8.13(d)4]
3	The permittee shall post the name of the contact person, together with the address and phone number, on a permanent, legible sign in a conspicuous location of the SVE system prior to beginning the work to be performed in accordance with this permit approval. [N.J.A.C. 7:27- 8]	None.	None.	None.

New Jersey Department of Environmental Protection
Facility Specific Requirements

Ref.#	Applicable Requirement	Monitoring Requirement	Recordkeeping Requirement	Submittal/Action Requirement
4	The permittee shall notify the NJDEP Northern Regional Enforcement Office in writing at least seven (7) days prior to the start-up of the SVE system for the first time. [N.J.A.C. 7:27- 8]	None.	None.	Submit a report: As per the approved schedule : Seven (7) days prior to the start-up of the SVE system, to the NJDEP, Northern Regional Enforcement Office. [N.J.A.C. 7:27- 8]
5	The permittee shall notify the Northern Regional Enforcement Office in writing within thirty (30) days of the full completion of the operation of the SVE system and shutting it down permanently. [N.J.A.C. 7:27- 8.13(d)4]	None.	None.	Submit a report: Once initially, or upon closure to the NJDEP, Northern Regional Enforcement Office. [N.J.A.C. 7:27- 8.13(d)4]
6	The equipment specified in this permit shall not cause any air contaminant, including an air contaminant detectable by the sense of smell, to be present in outdoor atmosphere in such quantity and duration which is, or tends to be, injurious to human health or welfare, animal or plant life or property, or would unreasonably interfere with the enjoyment of life or property. This shall not include an air contaminant which occurs only in areas over which the owner or operator has exclusive use or occupancy. [N.J.A.C. 7:27- 8]	None.	Recordkeeping by manual logging of parameter or storing data in a computer data system upon occurrence of event. The permittee shall record date and time when the operation of permitted equipment caused or has the potential to cause off-property effects. "Potential to cause" means an instance when the equipment begins to emit an odor, fugitive dust or other contaminant which may result in off-property complaints. All records shall be kept on-site or at the permittee's main office for at least five (5) years, readily made available to the Department or its representatives upon request. [N.J.A.C. 7:27- 8]	Submit notification: Upon occurrence of event : The permittee shall report any operation of the equipment which may cause a release of air contaminants in a quantity which poses a potential threat to public health, welfare, or the environment or which might reasonably result in citizen complaints. The permittee shall immediately notify the Department of any non-compliance by calling the New Jersey Environmental Protection Action Hotline at (877) 927-6337. [N.J.A.C. 7:27- 8]
7	No person shall use or cause to be used any equipment or control apparatus unless all components are connected or attached to, or serving the equipment or control apparatus, are functioning properly and are in use in accordance with the preconstruction permit and certificate and all conditions and provisions hereto. [N.J.A.C. 7:27- 8]	None.	None.	None.

New Jersey Department of Environmental Protection
Facility Specific Requirements

Ref.#	Applicable Requirement	Monitoring Requirement	Recordkeeping Requirement	Submittal/Action Requirement
8	The potential to emit of VOC (total), speciated HAP and TXS identified by the permittee and any regulated criteria air pollutant shall be below their respective reporting threshold or deminimis levels as specified in N.J.A.C. 7:27-8 Appendix 1, Table A and B, or 0.05 lb/hr, whichever is applicable. [N.J.A.C. 7:27- 8.13(h)]	Monitored by grab sampling semiannually: once every six months; six month cycle shall begin on January 1 and July 1 of each year, based on the averaging period as per Department approved test method using state and federally approved analytical laboratory air sampling and testing methodologies as follow: A TO-15 grab air sample using summa canister will be collected at the stack downstream from CD2 upon startup of the SVE treatment system, and semi-annually during the first year after startup. The permittee shall calculate maximum hourly emission rate and corresponding yearly emission of any air contaminant identified in the permittee's application using semi-annually analytical laboratory air sampling and testing results. After the first year, the permittee may petition the Department to reduce the frequency of analytical laboratory sampling and testing at the stack. The Department reserves the right to change the frequency of analytical laboratory sampling & testing of effluent gas based on a review of the VOC (total) and speciated HAPs/TXS analytical laboratory testing results. [N.J.A.C. 7:27- 8]	Recordkeeping by certified lab analysis results semiannually: once every six months; six month cycle shall begin on January 1 and July 1 of each year. All analytical laboratory air sampling and testing results including emissions calculations shall be kept on site or at the permittee's main office for at least five (5) years, readily made available to the Department or its representatives upon request. [N.J.A.C. 7:27- 8]	None.

KLOCKNER & KLOCKNER (26792)
PCP120001

Date: 1/14/2013

New Jersey Department of Environmental Protection
Reason for Application

Permit Being Modified

Permit Class: **Number:** 0

Description of Modifications: The proposed SVE system will be installed to address soil contaimation at this Superfund Site. The design is based on a pilot test conducted in November 2010, under permit activity number: EIP10002

KLOCKNER & KLOCKNER (26792)
PCP120001

New Jersey Department of Environmental Protection
Facility Profile (General)

Facility Name (AIMS): Klockner & Klockner

Facility ID (AIMS): 26792

Street Address: 10 STICKEL AVE
ROCKAWAY, NJ 07866

Mailing Address: RIKER DANZING SHERER HYLAND PERRETI
C/O MICHELE GLASS
HEADQUARTERS PLZ ONE SPEEDWELL AVE
MORRISTOWN, NJ 07962

State Plane Coordinates:

X-Coordinate:	490,594
Y-Coordinate:	755,270
Units:	New Jersey State Plane ٤
Datum:	
Source Org.:	
Source Type:	

County: Morris

Location Description: The site is located in Rockaway Borough. It is an industrial site.

Industry:

Primary SIC:	
Secondary SIC:	
NAICS:	531120

KLOCKNER & KLOCKNER (26792)
PCP120001

New Jersey Department of Environmental Protection
Facility Profile (General)

Contact Type: BAQE - Engineering

Organization: N.J. Department of Environmental Protection
Org. Type: State
Name: Negib Harfouche, Ph.D.
NJ EIN:
Title: Environmental Engineer 3
Phone: (609) 292-2137 x
Fax: (609) 984-6369 x
Other: ( ) - x
Type:
Email: negib.harfouche@dep.state.nj.us
Mailing Address: Bureau of Air Permits (DAQ)
401 East State Street-2nd Floor
Mailcode:401-02 P.O.Box 420
Trenton, NJ 08625-0420

Contact Type: Consultant

Organization: TRC Environmental Corporation
Org. Type: Corporation
Name: Howard Nichols III
NJ EIN:
Title: Sr. Project Manager
Phone: (973) 564-6006 x
Fax: (973) 564-6131 x
Other: ( ) - x
Type:
Email: hnichols@trcsolutions.com
Mailing Address: 57 E Willow St
Millburn, NJ 07041

Contact Type: EPA Official

Organization: US EPA
Org. Type: Federal
Name: Brian Quinn
NJ EIN:
Title: Project Manager
Phone: (212) 637-4381 x
Fax: ( ) - x
Other: ( ) - x
Type:
Email: quinn.brian@epamail.epa.gov
Mailing Address: U.S. Environmental Protection Agency
NJ Remediation Branch
290 Broadway 19th Floor
New York, NY 10007

KLOCKNER & KLOCKNER (26792)
PCP120001

New Jersey Department of Environmental Protection
Facility Profile (General)

Contact Type: On-Site Manager

Organization: TRC Environmental Corporation
Org. Type: Corporation
Name: Howard Nichols III
NJ EIN:
Title: Senior Project Manager
Phone: (973) 564-6006 x
Fax: (973) 564-6131 x
Other: ( ) - x
Type:
Email: hnichols@trcsolutions.com
Mailing Address: 57 E Willow Street
Millburn, NJ 07041

Contact Type: Responsible Official

Organization: Klockner and Klockner
Org. Type: LLC
Name: Daniel Klockner III
NJ EIN:
Title: President
Phone: (908) 362-6062 x
Fax: ( ) - x
Other: ( ) - x
Type:
Email:
Mailing Address: PO Box 343
Blairstown, NJ 07825

Contact Type: Responsible Party

Organization: Klockner and Klockner
Org. Type: LLC
Name: Daniel Klockner III
NJ EIN:
Title: President
Phone: (908) 362-6062 x
Fax: ( ) - x
Other: ( ) - x
Type:
Email:
Mailing Address: PO Box 343
Blairstown, NJ 07825

KLOCKNER & KLOCKNER (26792) Date: 1/14/2013

PCP120001

New Jersey Department of Environmental Protection
Equipment Inventory

Equip. NJID	Facility's Designation	Equipment Description	Equipment Type	Certificate Number	Install Date	Grand-Fathered	Last Mod. (Since 1968)	Equip. Set ID
E1	SVE Blower	SVE Blower	Soil Venting Equipment		12/3/2012	No	12/3/2012	

KLOCKNER & KLOCKNER (26792) Date: 1/14/2013

PCP120001

New Jersey Department of Environmental Protection
Control Device Inventory

CD NJID	Facility's Designation	Description	CD Type	Install Date	Grand-Fathered	Last Mod. (Since 1968)	CD Set ID
CD1	GAC-1	GAC-1	Adsorber	1/20/2013	No	1/20/2013	
CD2	GAC-2	GAC-2	Adsorber	12/3/2012	No	1/20/2013	

KLOCKNER & KLOCKNER (26792)
PCP120001

Date: 1/14/2013

New Jersey Department of Environmental Protection
Emission Points Inventory

PT NJID	Facility's Designation	Description	Config.	Equiv. Diam. (in.)	Height (ft.)	Dist. to Prop. Line (ft)	Exhaust Temp. (deg. F)			Exhaust Vol. (acfm)			Discharge Direction	PT Set ID
							Avg.	Min.	Max.	Avg.	Min.	Max.		
PT1	EP-1	Exhaust stack after GAC adsorbers	Round	2	16	15	100.0	50.0	180.0	400.0	300.0	460.0	Up	

KLOCKNER & KLOCKNER (26792)
PCP120001

Date: 1/14/2013

New Jersey Department of Environmental Protection
Emission Unit/Batch Process Inventory

U 1 SVE-Full1 SVE Full Scale System

UOS NJID	Facility's Designation	UOS Description	Operation Type	Signif. Equip.	Control Device(s)	Emission Point(s)	SCC(s)	Annual Oper. Hours		VOC Range	Flow (acfm)		Temp. (deg F)	
								Min.	Max.		Min.	Max.	Min.	Max.
OS1	SVE	SVE Full Scale System	Normal - Steady State	E1	CD1 (P) CD2 (S)	PT1		8,000.0	8,760.0	C	300.0	460.0	50.0	180.0

APPENDIX C

OPERATION LOG SHEETS

Table 1
Pre-Start Up Checklist and Start-Up Procedures
Klockner & Klockner
163292

Pre-Start Up Checklist

	Inspection Item	*Completed? Y/N*	*Comments*
1	Verify that power is disconnected at main disconnect.		
2	Verify that all valves to all SVE wells are in the fully open position.		
3	Verify that all vapor points are capped.		
4	Verify that dilution valve is in the fully open position.		
5	Verify that both HOA switches are in the OFF position.		
6	Verify that the valve to Header line #1 is fully open and valves to Header lines #2 & #3 are fully closed.		
7	Test vacuum relief valve to ensure correct functionality.		
8	Verify that drain port on VLS tank is in the closed position.		
9	Inspect electrical components for frayed wiring, corrosion, etc.		
10	Inspect all above ground piping for visible cracks, corrosion, etc.		

Comments

Start Up Procedures

1	Move lever on main electrical disconnect to ON position.
2	Turn HOA switch for VLS pump to Auto position.
3	Turn HOA switch for blower to Auto position.
4	Allow system to run with only one Header line open for about 1 hour while monitoring system. Record start time below.
5	Use portable smoke machine to place smoke around well vaults or piping to check for vacuum leaks in operating zone.
6	Monitor discharge temperature and pressure gauges to ensure acceptable levels. Note any issues or questionable items in the comments section below. If discharge pressure exceeds acceptable limits, shut down system and notify TRC immediately.
7	Once system has stabilized and run for about 1 hour, slowly open valve to Header line #2, then slowly close valve to Header line #1 and repeat steps 4 - 6. Record Start/Stop times below.
8	Once system has stabilized and run for about 1 hour, slowly open valve to Header line #3, then slowly close valve to Header line #2 and repeat steps 4 - 6. Record Start/Stop times below.
9	Once system has stabilized and run for about 1 hour, slowly open valves to Header lines #1 & #2 so that all Header lines are open. Record Start/Stop times below.
10	Monitor system for 1 hour, note any issues in comments section below.
11	After monitoring for about 1 hour, close valves to Header lines #2 & #3 so that only one header line is running at a time.

	Start Time	Stop Time
Header Line #1 Operating		
Header Line #2 Operating		
Header Line #3 Operating		
All Header Lines Operating		

Comments

Table 2
Applied Induced Vacuum/Perimeter Air Monitoring Log Sheet
Klockner and Klockner
Rockaway, NJ
TRC Project #: 163292

		Header Operating Upon Arrival to Site	
Date:	TRC Personnel:	Header 1	
Arrival Time:		Header 2	
Departure Time:	Weather:	Header 3	

Objective:

Header Operating Times												
	Header 1				Header 2				Header 3			
Start												
Stop												

Applied/Induced Vacuum Readings

	Location	Time	Vacuum	Time	Vacuum	Time	Vacuum	Time	Vacuum	Diff. Pressure (in. H2O)	Flow Rate (scfm)
Header 1	SVE-3										
	SVE-2										
	SVE-5										
	SVE-8										
	VP-15										
	VP-16										
	VP-17										
	VP-18										
	VP-19										
	VP-20										
	VP-21										
	VP-22										
Header 2	SVE-1										
	SVE-4										
	SVE-6										
	SVE-7										
	VP-1										
	VP-2										
	VP-3										
	VP-4										
	VP-5										
	VP-6										
	VP-7										
	VP-8										
Header 3	SVE-11										
	VET-1										
	SVE-10										
	SVE-9										
	VP-8										
	VP-9										
	VP-10										
	VP-11										
	VP-12										
	VP-13										
	VP-14										
	VP-23										
	VP-24										
	VP-25										

Perimeter Air Monitoring Locations									
	PM-1	PM-2	PM-3	PM-4	PM-5	PM-6	PM-7	PM-8	PM-9
Reading									
Time									

TABLE 3
SVE SYSTEM LOG SHEET
ROCKAWAY BOROUGH WELLFIELD SUPERFUND SITE
OU-3: KLOCKNER & KLOCKNER SOURCE AREA
ROCKAWAY, NEW JERSEY

Site Name: Klockner & Klockner TRC Personnel: _____ Page: ____ of: ____

Project No.: 163292 Objective: _____

Date: _____ VLS Level: _____

Weather: _____ Visible Emissions: _____ (Exclusive of water vapor)

System: SVE

Date/Time	Vacuum at Manifold	Flow Meter	Influent Temp	Knockout Tank Vacuum	Pre-Filter Vacuum	Post-Filter Vacuum	Differential Pressure	Blower Flow Rate	Operating Headers	Effluent Temp	Effluent Pressure	Influent PID	Mid Carbon PID	Effluent PID	SVE Blower	VLS Pump	Dilution Valve
	inches of H_2O	scfm	°F	inches of H_2O	inches of H_2O	inches of H_2O	inches of H_2O	scfm	#	°F	inches of H_2O	ppm	ppm	ppm	hours	hours	% Open

Header 1: **SVE-2, SVE-3, SVE-5, SVE-8** **Header 2:** **SVE-1, SVE-4, SVE-6, SVE-7** **Header 3:** **VET-1, SVE-9, SVE-10, SVE-11**

Notes:

NR = Not Recorded
NA = Not Applicable

APPENDIX D

BUILDING 12 SVE WELL, VP, AND VET CONSTRUCTION LOGS

TRC Environmental Corporation

57 E. Willow Street, Millburn, NJ 07041 (973) 564-6006

SOIL BORING LOG

BORING NUMBER

VET-1

PROJECT NAME: Klockner & Klockner **LOCATION:** Rockaway, New Jersey

PROJECT NO.: 163292 **CONTRACTOR:** Goldstar Environmental

DATE EXCAVATED: **08/26/10**

SAMPLER TYPE/DIA.: Excavation **DEPTH TO WATER:**

OPERATOR **Mike Trappett**

BORING METHOD: Backhoe **TOTAL DEPTH :** 7'

LOGGED BY: **PHOTO LOGGED**

DEPTH FROM SURFACE (FEET)	BLOW COUNT PER 6 IN.	RECOVERY (INCHES)	PID (ppm)	CONSTRUCTION	UNIFIED	LITHOLOGIC CLASSIFICATION AND COMMENTS
0						
1			ND	ASPHALT		0 to 0.5' - Asphalt
				BAKFILL WITH EXCAVATED TRENCH SPOILS		0.5-4.5' - Fill: Silty Sand, little coarse gravel, noted a cavity (dry well) cased with bricks at 3.5' on the East Side of the trench
6				GRAVEL		4.5 to 7.0' - Brown fine to medium sand, little silt, some coarse gravel
8						END OF TRENCH AT 7' Note: Gravel backfill is 3/4" (5.5' to 7') 4"-diameter, 0.010"- slotted pipe placed at 6.5' below grade

NORTHING	EASTING	GROUND ELEVATION
ft. msl	ft. msl	ft. msl
755,229.65	490,634.35	523.10

TRC Environmental Corporation
57 E. Willow Street, Millburn, NJ 07041 (973) 564-6006

WELL LOG

WELL NUMBER
SVE-1
WELL PERMIT NUMBER

PROJECT NAME: Klockner & Klockner
LOCATION: Rockaway, New Jersey
PROJECT NO.: 163292
CONTRACTOR: Goldstar Environmental

START DATE: **08/31/10**
FINISH DATE: **08/31/10**
DRILLER: **Mike Trappett**
LOGGED BY: **SB**

SAMPLER TYPE/DIA.: None
DEPTH TO BEDROCK: NA
TOTAL DEPTH DRILLED: 11 feet
TYPE OF WELL: Soil vapor extraction
DRILLING METHOD: Hollow Stem Auger
BIT TYPE: Auger bit

DEPTH FROM SURFACE (FEET)	BLOW COUNT PER 6 IN.	RECOVERY (INCHES)	PID (ppm)	SAMPLE DESIGNATION	WELL DIAGRAM	UNIFIED	LITHOLOGIC CLASSIFICATION AND COMMENTS
0							Flush Mount
1							0-1.5': Cement Grout
2							1.5-2' : Bentonite seal
3							2-11': No. 0 Sand pack
4							
5							
6							
7							At ~7: Backfill material (glass) and dark brown silt and fine to coarse sand with gravel
8							
9							Well construction details:
10							0-2.5' : 4" PVC riser with male adapter
11							2.5-11' : 4" PVC screen
12							End of drilling at 11'; Well set at 11' ; Water not encountered
13							
14							
15							

CASING TYPE/DIAMETER (IN.)
INNER: 4" OUTER: NA

STATIC WATER LEVEL: NA feet below surface
DEPTH WATER ENCOUNTERED: NA feet below surface

SCREENED OR OPEN INTERVAL: 2.5-11
(FEET BELOW SURFACE)

NORTHING /EASTING: 755,261.0 / 490,604.10 ft., msl
GROUND SURFACE ELEVATION: 523.50 ft., msl

TRC **Environmental Corporation**

57 E. Willow Street, Millburn, NJ 07041 (973) 564-6006

WELL LOG

WELL NUMBER

SVE-2

WELL PERMIT NUMBER

PROJECT NAME: Klockner & Klockner **LOCATION:** Rockaway, New Jersey

PROJECT NO.: 163292 **CONTRACTOR:** ECDI

START DATE: **11/05/12**

FINISH DATE: **11/05/12**

DRILLER: **Steve Moylan**

LOGGED BY: **K. Lau**

SAMPLER TYPE/DIA.: NA **TYPE OF WELL:** SVE

DEPTH TO BEDROCK: NA **DRILLING METHOD:** Hollow Stem Auger

TOTAL DEPTH DRILLED: 14 feet **BIT TYPE:** Auger Bit

DEPTH FROM SURFACE (FEET)	BLOW COUNT PER 6 IN.	RECOVERY (INCHES)	PID (ppm)	SAMPLE DESIGNATION	WELL DIAGRAM	UNIFIED	LITHOLOGIC CLASSIFICATION AND COMMENTS
0							Flush Mount
1			0				0 to 5' - Brown fine SAND, little coarse gravel.
2							
3							
4							
5							
6			0				5 to 8' - Brown fine SAND, little fine gravel.
7							
8							
9			0				8 to 14' - Brown fine to medium SAND.
10							Well Construction Details 0 to 3.5 ft. below surface - 4" diameter PVC riser 3.5 to 13 ft. below surface - 4" diameter 10 slot PVC screen
11							0.5 to 2.5 ft. below surface - Portland cement/Bentonix mix 2.5 to 3.0 ft. below surface - Bentonite seal
12							3.0 to 14 ft. below surface - No. 0 sand
13							
14							
15							End of boring at 14 feet below surface.

CASING TYPE/DIAMETER (IN.)

INNER: 4 OUTER: NA

STATIC WATER LEVEL: NA feet below surface

DEPTH WATER ENCOUNTERED: NA feet below surface

SCREENED OR OPEN INTERVAL: 3.5 to 13
(FEET BELOW SURFACE)

NORTHING /EASTING: 755,117 / 490,525 ft., msl

GROUND SURFACE ELEVATION: 523.00 ft., msl

TRC Environmental Corporation
57 E. Willow Street, Millburn, NJ 07041 (973) 564-6006

WELL LOG

WELL NUMBER
SVE-3
WELL PERMIT NUMBER

PROJECT NAME: Klockner & Klockner
LOCATION: Rockaway, New Jersey
PROJECT NO.: 163292
CONTRACTOR: ECDI

START DATE: **11/06/12**
FINISH DATE: **11/06/12**
DRILLER: **Steve Moylan**
LOGGED BY: **K. Lau**

SAMPLER TYPE/DIA.: NA
TYPE OF WELL: SVE
DEPTH TO BEDROCK: NA
DRILLING METHOD: Hollow Stem Auger
TOTAL DEPTH DRILLED: 14 feet
BIT TYPE: Auger Bit

DEPTH FROM SURFACE (FEET)	BLOW COUNT PER 6 IN.	RECOVERY (INCHES)	PID (ppm)	SAMPLE DESIGNATION	WELL DIAGRAM	UNIFIED	LITHOLOGIC CLASSIFICATION AND COMMENTS
0							Flush Mount
1			0				0 to 2' - Backfill material.
2			0				2 to 5' - Coarse GRAVEL, some sand.
3							
4							
5							
6			0				5 to 8' - Brown medium to fine SAND, little fine gravel, dry.
7							
8							
9			0				8 to 14' - Brown fine SAND, dry.
10							Well Construction Details 0 to 3.5 ft. below surface - 4" diameter PVC riser
11							3.5 to 13 ft. below surface - 4" diameter 10 slot PVC screen 0.5 to 2.5 ft. below surface - Portland cement/Bentonix mix
12							2.5 to 3.0 ft. below surface - Bentonite seal 3.0 to 14 ft. below surface - No. 0 sand
13							
14							
15							End of boring at 14 feet below surface.

CASING TYPE/DIAMETER (IN.)
INNER: 4 OUTER: NA

STATIC WATER LEVEL: NA feet below surface
DEPTH WATER ENCOUNTERED: NA feet below surface

SCREENED OR OPEN INTERVAL: 3.5 to 13
(FEET BELOW SURFACE)

NORTHING /EASTING: 755,167 / 490549 ft., msl
GROUND SURFACE ELEVATION: 522.80 ft., msl

TRC **Environmental Corporation**

57 E. Willow Street, Millburn, NJ 07041 (973) 564-6006

WELL LOG

WELL NUMBER

SVE-4

WELL PERMIT NUMBER

PROJECT NAME: Klockner & Klockner **LOCATION:** Rockaway, New Jersey

PROJECT NO.: 163292 **CONTRACTOR:** ECDI

START DATE: **11/09/12**

FINISH DATE: **11/09/12**

DRILLER: **Steve Moylan**

LOGGED BY: **K. Lau**

SAMPLER TYPE/DIA.: NA **TYPE OF WELL:** SVE

DEPTH TO BEDROCK: NA **DRILLING METHOD:** Vacuum

TOTAL DEPTH DRILLED: 13 feet **BIT TYPE:** NA

DEPTH FROM SURFACE (FEET)	BLOW COUNT PER 6 IN.	RECOVERY (INCHES)	PID (ppm)	SAMPLE DESIGNATION	WELL DIAGRAM	UNIFIED	LITHOLOGIC CLASSIFICATION AND COMMENTS
0							Flush Mount
1							0.5 to 4' - Brown medium to fine SAND, some coarse gravel.
2							
3							
4							4 to 10' - Brown fine SAND.
5							
6							
7							
8							10 to 13' - Brown fine SAND, little gravel, dry.
9							
10							Well Construction Details 0 to 3.5 ft. below surface - 4" diameter PVC riser 3.5 to 13 ft. below surface - 4" diameter 10 slot PVC screen
11							0.5 to 2.5 ft. below surface - Portland cement/Bentonix mix 2.5 to 3.0 ft. below surface - Bentonite seal
12							3.0 to 13.5 ft. below surface - No. 0 sand
13							
14							End of boring at 13.5 feet below surface.
15							

CASING TYPE/DIAMETER (IN.)

INNER: 4 OUTER: NA

STATIC WATER LEVEL: ND feet below surface

DEPTH WATER ENCOUNTERED: 13.00 feet below surface

SCREENED OR OPEN INTERVAL: 3.5 to 13
(FEET BELOW SURFACE)

NORTHING /EASTING: 755,203 / 490,533 ft., msl

GROUND SURFACE ELEVATION: 522.90 ft., msl

TRC Environmental Corporation

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WELL LOG

WELL NUMBER

SVE-5

WELL PERMIT NUMBER

PROJECT NAME: Klockner & Klockner **LOCATION:** Rockaway, New Jersey

PROJECT NO.: 163292 **CONTRACTOR:** ECDI

START DATE: **11/07/12**

FINISH DATE: **11/07/12**

DRILLER: **Steve Moylan**

LOGGED BY: **K. Lau**

SAMPLER TYPE/DIA.: NA **TYPE OF WELL:** SVE

DEPTH TO BEDROCK: NA **DRILLING METHOD:** Hollow Stem Auger

TOTAL DEPTH DRILLED: 14 feet **BIT TYPE:** Auger Bit

DEPTH FROM SURFACE (FEET)	BLOW COUNT PER 6 IN.	RECOVERY (INCHES)	PID (ppm)	SAMPLE DESIGNATION	WELL DIAGRAM	UNIFIED	LITHOLOGIC CLASSIFICATION AND COMMENTS
0							Flush Mount
1			0				0.5 to 2' - Brown fine SAND, little coarse gravel.
2							
3			0				2 to 6' - Brown fine SAND, dry, little coarse gravel.
4							
5							
6							
7			0				6 to 10' - Light brown fine SAND, dry.
8							
9							
10							
11			0				10 to 14' - Light brown fine SAND, little fine gravel.
12							Well Construction Details
13							0 to 3.5 ft. below surface - 4" diameter PVC riser
14							3.5 to 13 ft. below surface - 4" diameter 10 slot PVC screen
15							0.5 to 2.5 ft. below surface - Portland cement/Bentonix mix
							2.5 to 3.0 ft. below surface - Bentonite seal
							3.0 to 14 ft. below surface - No. 0 sand
							End of boring at 14 feet below surface.

CASING TYPE/DIAMETER (IN.)

INNER: 4 OUTER: NA

STATIC WATER LEVEL: NA feet below surface

DEPTH WATER ENCOUNTERED: NA feet below surface

SCREENED OR OPEN INTERVAL: 3.5 to 13
(FEET BELOW SURFACE)

NORTHING /EASTING: 755,104 / 490,569 ft., msl

GROUND SURFACE ELEVATION: 522.90 ft., msl

TRC Environmental Corporation

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WELL LOG

WELL NUMBER

SVE-6

WELL PERMIT NUMBER

PROJECT NAME: Klockner & Klockner **LOCATION:** Rockaway, New Jersey

PROJECT NO.: 163292 **CONTRACTOR:** ECDI

START DATE: **11/02/12**
FINISH DATE: **11/02/12**
DRILLER: **Steve Moylan**
LOGGED BY: **K. Lau**

SAMPLER TYPE/DIA.: NA **TYPE OF WELL:** SVE
DEPTH TO BEDROCK: NA **DRILLING METHOD:** Hollow Stem Auger
TOTAL DEPTH DRILLED: 14 feet **BIT TYPE:** Auger Bit

DEPTH FROM SURFACE (FEET)	BLOW COUNT PER 6 IN.	RECOVERY (INCHES)	PID (ppm)	SAMPLE DESIGNATION	WELL DIAGRAM	UNIFIED	LITHOLOGIC CLASSIFICATION AND COMMENTS
0							Flush Mount
1			0				0 to 2' - Backfill material.
2			0				2 to 4' - Dark brown medium to fine SAND, little silt and clay.
3							
4			0				4 to 5' - Coarse GRAVEL, some sand.
5			1.1				5 to 10' - Brown fine to medium SAND, little fine gravel, dry.
6							
7							
8							
9							
10			0				10 to 14' - Brown fine to medium SAND, dry.
11							Well Construction Details
12							0 to 3.5 ft. below surface - 4" diameter PVC riser 3.5 to 13 ft. below surface - 4" diameter 10 slot PVC screen
13							0.5 to 2.5 ft. below surface - Portland cement/Bentonix mix 2.5 to 3.0 ft. below surface - Bentonite seal
14							3.0 to 14 ft. below surface - No. 0 sand
15							End of boring at 14 feet below surface.

CASING TYPE/DIAMETER (IN.)

INNER: 4 OUTER: NA

STATIC WATER LEVEL: NA feet below surface

DEPTH WATER ENCOUNTERED: NA feet below surface

SCREENED OR OPEN INTERVAL: 3.5 to 13
(FEET BELOW SURFACE)

NORTHING /EASTING: 755,175 / 490,584 ft., msl

GROUND SURFACE ELEVATION: 525.40 ft., msl

Environmental Corporation

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WELL LOG

WELL NUMBER

SVE-7

WELL PERMIT NUMBER

PROJECT NAME: Klockner & Klockner **LOCATION:** Rockaway, New Jersey

PROJECT NO.: 163292 **CONTRACTOR:** ECDI

START DATE: **11/07/12**

FINISH DATE: **11/07/12**

DRILLER: **Steve Moylan**

LOGGED BY: **K. Lau**

SAMPLER TYPE/DIA.: NA **TYPE OF WELL:** SVE

DEPTH TO BEDROCK: NA **DRILLING METHOD:** Hollow Stem Auger

TOTAL DEPTH DRILLED: 14 feet **BIT TYPE:** Auger Bit

DEPTH FROM SURFACE (FEET)	BLOW COUNT PER 6 IN.	RECOVERY (INCHES)	PID (ppm)	SAMPLE DESIGNATION	WELL DIAGRAM	UNIFIED	LITHOLOGIC CLASSIFICATION AND COMMENTS
0							Flush Mount
1			0				0.5 to 1' - Backfill material.
2			0				1 to 4' - Backfill material, large boulders of concrete.
3							
4							
5			0				4 to 6' - Brown fine to medium SAND, little coarse gravel.
6							
7			0				6 to 14' - Brown fine SAND, dry.
8							Well Construction Details 0 to 3.5 ft. below surface - 4" diameter PVC riser
9							3.5 to 13 ft. below surface - 4" diameter 10 slot PVC screen 0.5 to 2.5 ft. below surface - Portland cement/Bentonix mix
10							2.5 to 3.0 ft. below surface - Bentonite seal 3.0 to 14 ft. below surface - No. 0 sand
11							
12							
13							
14							
15							End of boring at 14 feet below surface.

CASING TYPE/DIAMETER (IN.)

INNER: 4 OUTER: NA

STATIC WATER LEVEL: NA feet below surface

DEPTH WATER ENCOUNTERED: NA feet below surface

SCREENED OR OPEN INTERVAL: 3.5 to 13
(FEET BELOW SURFACE)

NORTHING /EASTING: 755,205 / 490,578 ft., msl

GROUND SURFACE ELEVATION: 522.90 ft., msl

TRC Environmental Corporation

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WELL LOG

WELL NUMBER

SVE-8

WELL PERMIT NUMBER

PROJECT NAME: Klockner & Klockner **LOCATION:** Rockaway, New Jersey

PROJECT NO.: 163292 **CONTRACTOR:** ECDI

START DATE: **11/08/12**

FINISH DATE: **11/08/12**

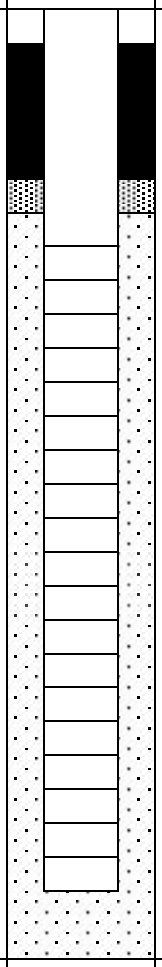
DRILLER: **Steve Moylan**

LOGGED BY: **K. Lau**

SAMPLER TYPE/DIA.: NA **TYPE OF WELL:** SVE

DEPTH TO BEDROCK: NA **DRILLING METHOD:** Hollow Stem Auger

TOTAL DEPTH DRILLED: 14 feet **BIT TYPE:** Auger Bit

DEPTH FROM SURFACE (FEET)	BLOW COUNT PER 6 IN.	RECOVERY (INCHES)	PID (ppm)	SAMPLE DESIGNATION	WELL DIAGRAM	UNIFIED	LITHOLOGIC CLASSIFICATION AND COMMENTS
0							Flush Mount
1			0				0.5 to 3' - Backfill material, coarse gravel, brown medium sand.
2							
3							
4			0				3 to 8' - Brown medium to fine SAND, little fine gravel.
5							
6							
7							
8							
9			1.8				8 to 14' - Brown fine SAND, dry.
10							Well Construction Details 0 to 3.5 ft. below surface - 4" diameter PVC riser
11							3.5 to 13 ft. below surface - 4" diameter 10 slot PVC screen 0.5 to 2.5 ft. below surface - Portland cement/Bentonix mix
12							2.5 to 3.0 ft. below surface - Bentonite seal 3.0 to 14 ft. below surface - No. 0 sand
13							
14							
15							End of boring at 14 feet below surface.

CASING TYPE/DIAMETER (IN.)

INNER: 4 OUTER: NA

STATIC WATER LEVEL: NA feet below surface

DEPTH WATER ENCOUNTERED: NA feet below surface

SCREENED OR OPEN INTERVAL: 3.5 to 13
(FEET BELOW SURFACE)

NORTHING /EASTING: 755,086 / 490,631 ft., msl

GROUND SURFACE ELEVATION: 522.80 ft., msl

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WELL LOG

WELL NUMBER
SVE-9
WELL PERMIT NUMBER

PROJECT NAME: Klockner & Klockner
LOCATION: Rockaway, New Jersey
PROJECT NO.: 163292
CONTRACTOR: ECDI

START DATE: **11/14/12**
FINISH DATE: **11/14/12**
DRILLER: **Steve Moylan**
LOGGED BY: **K. Lau**

SAMPLER TYPE/DIA.: NA
TYPE OF WELL: SVE
DEPTH TO BEDROCK: NA
DRILLING METHOD: Hollow Stem Auger
TOTAL DEPTH DRILLED: 14 feet
BIT TYPE: Auger Bit

DEPTH FROM SURFACE (FEET)	BLOW COUNT PER 6 IN.	RECOVERY (INCHES)	PID (ppm)	SAMPLE DESIGNATION	WELL DIAGRAM	UNIFIED	LITHOLOGIC CLASSIFICATION AND COMMENTS
0							Flush Mount
1			0				0 to 1' - Dark brown fine to medium SAND.
2			0				1 to 13.5' - Light brown fine SAND, dry.
3							
4							
5							
6							
7							
8							Well Construction Details 0 to 3.5 ft. below surface - 4" diameter PVC riser
9							3.5 to 13.5 ft. below surface - 4" diameter 10 slot PVC screen 0.5 to 2.5 ft. below surface - Portland cement/Bentonix mix
10							2.5 to 3.0 ft. below surface - Bentonite seal 3.0 to 14 ft. below surface - No. 0 sand
11							
12							
13							
14			0				13.5 to 14' - Brown fine SAND, wet.
15							End of boring at 14 feet below surface.

CASING TYPE/DIAMETER (IN.)
INNER: 4 OUTER: NA

STATIC WATER LEVEL: ND feet below surface
DEPTH WATER ENCOUNTERED: 13.50 feet below surface

SCREENED OR OPEN INTERVAL: 3.5 to 13.5
(FEET BELOW SURFACE)

NORTHING /EASTING: 755,138 / 490,608 ft., msl
GROUND SURFACE ELEVATION: 523.10 ft., msl

TRC Environmental Corporation

57 E. Willow Street, Millburn, NJ 07041 (973) 564-6006

WELL LOG

WELL NUMBER

SVE-10

WELL PERMIT NUMBER

PROJECT NAME: Klockner & Klockner **LOCATION:** Rockaway, New Jersey

PROJECT NO.: 163292 **CONTRACTOR:** Goldstar

START DATE: **02/14/13**

FINISH DATE: **02/14/13**

DRILLER: **Mike**

LOGGED BY: **C. Georgiadis**

SAMPLER TYPE/DIA.: NA **TYPE OF WELL:** SVE

DEPTH TO BEDROCK: NA **DRILLING METHOD:** Hollow Stem Auger

TOTAL DEPTH DRILLED: 14 feet **BIT TYPE:** Auger Bit

DEPTH FROM SURFACE (FEET)	BLOW COUNT PER 6 IN.	RECOVERY (INCHES)	PID (ppm)	SAMPLE DESIGNATION	WELL DIAGRAM	UNIFIED	LITHOLOGIC CLASSIFICATION AND COMMENTS
0							Flush Mount
1			0				0 to 2"- Not backfilled; will be paved 0"-3" with asphalt
2							2" to 2.5' - Clean fill DGA from excavation activities
3							
4							
5							
6			0				2.5 to 8' - Brown-tan fine SAND, little fine gravel.
7							
8							
9			0				8 to 14' - Brown fine to medium SAND.
10							Well Construction Details
11							0 to 3 ft. below surface - 4" diameter PVC riser 3 to 13 ft. below surface - 4" diameter 10 slot PVC screen
12							0.5 to 2 ft. below surface - Portland cement/Bentonite mix 2 to 2.5 ft below surface- Bentonite seal
13							2.5 to 14 ft. below surface - No. 0 sand
14							
15							End of boring at 14 feet below surface.

CASING TYPE/DIAMETER (IN.)

INNER: 4 OUTER: NA

STATIC WATER LEVEL: NA feet below surface

DEPTH WATER ENCOUNTERED: NA feet below surface

SCREENED OR OPEN INTERVAL: 3 to 13
(FEET BELOW SURFACE)

NORTHING /EASTING: 755,183/490,618 ft., msl

GROUND SURFACE ELEVATION: 521.57 ft., msl

TRC Job No. 163292

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WELL LOG

WELL NUMBER

SVE-11

WELL PERMIT NUMBER

PROJECT NAME: Klockner & Klockner **LOCATION:** Rockaway, New Jersey

PROJECT NO.: 163292 **CONTRACTOR:** ECDI

START DATE: **11/13/12**

FINISH DATE: **11/13/12**

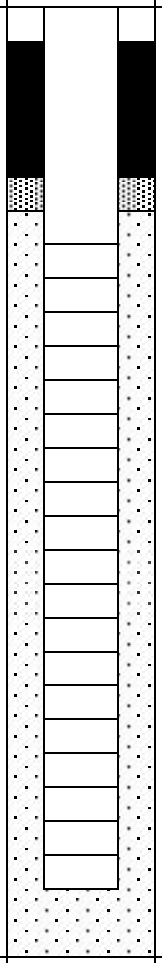
DRILLER: **Steve Moylan**

LOGGED BY: **K. Lau**

SAMPLER TYPE/DIA.: NA **TYPE OF WELL:** SVE

DEPTH TO BEDROCK: NA **DRILLING METHOD:** Hollow Stem Auger

TOTAL DEPTH DRILLED: 14 feet **BIT TYPE:** Auger Bit

DEPTH FROM SURFACE (FEET)	BLOW COUNT PER 6 IN.	RECOVERY (INCHES)	PID (ppm)	SAMPLE DESIGNATION	WELL DIAGRAM	UNIFIED	LITHOLOGIC CLASSIFICATION AND COMMENTS
0							Flush Mount
1			0.5 1 0.5				0 to 2" - Asphalt 2" to 0.5' - Brown fine to medium SAND, some fine gravel. 0.5 to 7' - Brown fine SAND, some fine gravel.
2							
3							
4							
5							
6							
7							
8			0.5				7 to 14' - Brown fine SAND, some fine gravel. Well Construction Details
9							0 to 3.5 ft. below surface - 4" diameter PVC riser
10							3.5 to 13 ft. below surface - 4" diameter 10 slot PVC screen 0.5 to 2.5 ft. below surface - Portland cement/Bentonix mix
11							2.5 to 3.0 ft. below surface - Bentonite seal 3.0 to 14 ft. below surface - No. 0 sand
12							
13							
14							
15							End of boring at 14 feet below surface.

CASING TYPE/DIAMETER (IN.)

INNER: 4 OUTER: NA

STATIC WATER LEVEL: NA feet below surface

DEPTH WATER ENCOUNTERED: NA feet below surface

SCREENED OR OPEN INTERVAL: 3.5 to 13.5
(FEET BELOW SURFACE)

NORTHING /EASTING: 755,238 / 490,606 ft., msl

GROUND SURFACE ELEVATION: 522.80 ft., msl

TRC Environmental Corporation

57 E. Willow Street, Millburn, NJ 07041 (973) 564-6006

WELL LOG

WELL NUMBER

VP-1

WELL PERMIT NUMBER

PROJECT NAME: Klockner & Klockner **LOCATION:** Rockaway, New Jersey

PROJECT NO.: 163292 **CONTRACTOR:** Goldstar Environmental

START DATE: **08/30/10**
FINISH DATE: **08/30/10**
DRILLER: **Mike Trappett**
LOGGED BY: **SB**

SAMPLER TYPE/DIA.: None **TYPE OF WELL:** Vapor Monitoring
DEPTH TO BEDROCK: NA **DRILLING METHOD:** Hollow Stem Auger
TOTAL DEPTH DRILLED: 11 feet **BIT TYPE:** Auger bit

DEPTH FROM SURFACE (FEET)	BLOW COUNT PER 6 IN.	RECOVERY (INCHES)	PID (ppm)	SAMPLE DESIGNATION	WELL DIAGRAM	UNIFIED	LITHOLOGIC CLASSIFICATION AND COMMENTS
0							Flush Mount
1							0-1.5': Cement Grout
2							1.5-2' : Bentonite seal
3							Refusal at 2'- offset 2-3' west of original location - refusal again at 2'- offset again 2-3' toward VP-4 2-11': No. 0 Sand pack
4							
5							
6							Well construction details: 0-2.5' : 1" PVC riser 2.5-11' : 1" PVC screen
7							
8							
9							
10							
11							
12							End of drilling at 11'; Well set at 11' ; Water not encountered
13							
14							
15							

CASING TYPE/DIAMETER (IN.)

INNER: 1" OUTER: NA

STATIC WATER LEVEL: NA feet below surface

DEPTH WATER ENCOUNTERED: NA feet below surface

SCREENED OR OPEN INTERVAL: 2.5-11
(FEET BELOW SURFACE)

NORTHING /EASTING: 755,264.30 / 490,592.98 ft., msl

GROUND SURFACE ELEVATION: 523.50 ft., msl

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WELL LOG

WELL NUMBER
VP-2
WELL PERMIT NUMBER

PROJECT NAME: Klockner & Klockner
LOCATION: Rockaway, New Jersey
PROJECT NO.: 163292
CONTRACTOR: Goldstar Environmental

START DATE: **08/26/10**
FINISH DATE: **08/26/10**
DRILLER: **Mike Trappett**
LOGGED BY: **RB**

SAMPLER TYPE/DIA.: None
DEPTH TO BEDROCK: NA
TOTAL DEPTH DRILLED: 11 feet
TYPE OF WELL: Vapor Monitoring
DRILLING METHOD: Hollow Stem Auger
BIT TYPE: Auger bit

DEPTH FROM SURFACE (FEET)	BLOW COUNT PER 6 IN.	RECOVERY (INCHES)	PID (ppm)	SAMPLE DESIGNATION	WELL DIAGRAM	UNIFIED	LITHOLOGIC CLASSIFICATION AND COMMENTS
0							Flush Mount
1							0-1.5': Cement Grout
2							1.5-2' : Bentonite seal
3							2-11': No. 0 Sand pack
4							
5							
6							Well construction details:
7							0-2.5' : 1" PVC riser
8							2.5-11' : 1" PVC screen
9							
10							
11							
12							End of drilling at 11'; Well set at 11' ; Water not encountered
13							
14							
15							

CASING TYPE/DIAMETER (IN.)
INNER: 1" OUTER: NA

STATIC WATER LEVEL: NA feet below surface
DEPTH WATER ENCOUNTERED: NA feet below surface

SCREENED OR OPEN INTERVAL: 2.5-11
(FEET BELOW SURFACE)

NORTHING /EASTING: 755,281.97 / 490,607.55 ft., msl
GROUND SURFACE ELEVATION: 524.30 ft., msl

TRC **Environmental Corporation**

57 E. Willow Street, Millburn, NJ 07041 (973) 564-6006

WELL LOG

WELL NUMBER

VP-3

WELL PERMIT NUMBER

PROJECT NAME: Klockner & Klockner **LOCATION:** Rockaway, New Jersey

PROJECT NO.: 163292 **CONTRACTOR:** Goldstar Environmental

START DATE: **08/30/10**
FINISH DATE: **08/30/10**
DRILLER: **Mike Trappett**
LOGGED BY: **SB**

SAMPLER TYPE/DIA.: None **TYPE OF WELL:** Vapor Monitoring
DEPTH TO BEDROCK: NA **DRILLING METHOD:** Hollow Stem Auger
TOTAL DEPTH DRILLED: 11 feet **BIT TYPE:** Auger bit

DEPTH FROM SURFACE (FEET)	BLOW COUNT PER 6 IN.	RECOVERY (INCHES)	PID (ppm)	SAMPLE DESIGNATION	WELL DIAGRAM	UNIFIED	LITHOLOGIC CLASSIFICATION AND COMMENTS
0							Flush Mount
1							0-1.5': Cement Grout
2							1.5-2' : Bentonite seal
3							2-11': No. 0 Sand pack
4							
5							
6							Well construction details:
7							0-2.5' : 1" PVC riser
8							2.5-11' : 1" PVC screen
9							
10							
11							
12							End of drilling at 11'; Well set at 11' ; Water not encountered
13							
14							
15							

CASING TYPE/DIAMETER (IN.)

INNER: 1" OUTER: NA

STATIC WATER LEVEL: NA feet below surface

DEPTH WATER ENCOUNTERED: NA feet below surface

SCREENED OR OPEN INTERVAL: 2.5-11
(FEET BELOW SURFACE)

NORTHING /EASTING: 755,267.90 / 490,605.67 ft., msl

GROUND SURFACE ELEVATION: 523.70 ft., msl

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WELL LOG

WELL NUMBER
VP-4
WELL PERMIT NUMBER

PROJECT NAME: Klockner & Klockner
LOCATION: Rockaway, New Jersey
PROJECT NO.: 163292
CONTRACTOR: Goldstar Environmental

START DATE: **08/30/10**
FINISH DATE: **08/30/10**
DRILLER: **Mike Trappett**
LOGGED BY: **SB**

SAMPLER TYPE/DIA.: None
DEPTH TO BEDROCK: NA
TOTAL DEPTH DRILLED: 11 feet
TYPE OF WELL: Vapor Monitoring
DRILLING METHOD: Hollow Stem Auger
BIT TYPE: Auger bit

DEPTH FROM SURFACE (FEET)	BLOW COUNT PER 6 IN.	RECOVERY (INCHES)	PID (ppm)	SAMPLE DESIGNATION	WELL DIAGRAM	UNIFIED	LITHOLOGIC CLASSIFICATION AND COMMENTS
0							Flush Mount
1							0-1.5': Cement Grout
2							1.5-2' : Bentonite seal
3							2-11': No. 0 Sand pack
4							
5							
6							Well construction details:
7							0-2.5' : 1" PVC riser
8							2.5-11' : 1" PVC screen
9							
10							
11							
12							End of drilling at 11'; Well set at 11' ; Water not encountered
13							
14							
15							

CASING TYPE/DIAMETER (IN.)
INNER: 1" OUTER: NA

STATIC WATER LEVEL: NA feet below surface
DEPTH WATER ENCOUNTERED: NA feet below surface

SCREENED OR OPEN INTERVAL: 2.5-11
(FEET BELOW SURFACE)

NORTHING /EASTING: 755,262.42 / 490,599.03 ft., msl
GROUND SURFACE ELEVATION: 523.50 ft., msl

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WELL LOG

WELL NUMBER
VP-5
WELL PERMIT NUMBER

PROJECT NAME: Klockner & Klockner
LOCATION: Rockaway, New Jersey
PROJECT NO.: 163292
CONTRACTOR: Goldstar Environmental

START DATE: **08/30/10**
FINISH DATE: **08/30/10**
DRILLER: **Mike Trappett**
LOGGED BY: **SB**

SAMPLER TYPE/DIA.: None
DEPTH TO BEDROCK: NA
TOTAL DEPTH DRILLED: 11 feet
TYPE OF WELL: Vapor Monitoring
DRILLING METHOD: Hollow Stem Auger
BIT TYPE: Auger bit

DEPTH FROM SURFACE (FEET)	BLOW COUNT PER 6 IN.	RECOVERY (INCHES)	PID (ppm)	SAMPLE DESIGNATION	WELL DIAGRAM	UNIFIED	LITHOLOGIC CLASSIFICATION AND COMMENTS
0							Flush Mount
1							0-1.5': Cement Grout
2							1.5-2' : Bentonite seal
3							2-11': No. 0 Sand pack
4							
5							
6							Well construction details:
7							0-2.5' : 1" PVC riser
8							2.5-11' : 1" PVC screen
9							
10							
11							
12							End of drilling at 11'; Well set at 11' ; Water not encountered
13							
14							
15							

CASING TYPE/DIAMETER (IN.)
INNER: 1" OUTER: NA

STATIC WATER LEVEL: NA feet below surface
DEPTH WATER ENCOUNTERED: NA feet below surface

SCREENED OR OPEN INTERVAL: 2.5-11
(FEET BELOW SURFACE)

NORTHING /EASTING: 755,246.57 / 490,600.22 ft., msl
GROUND SURFACE ELEVATION: 523.00 ft., msl

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WELL LOG

WELL NUMBER
VP-6
WELL PERMIT NUMBER

PROJECT NAME: Klockner & Klockner
LOCATION: Rockaway, New Jersey
PROJECT NO.: 163292
CONTRACTOR: Goldstar Environmental

START DATE: **08/30/10**
FINISH DATE: **08/30/10**
DRILLER: **Mike Trappett**
LOGGED BY: **SB**

SAMPLER TYPE/DIA.: None
DEPTH TO BEDROCK: NA
TOTAL DEPTH DRILLED: 11 feet
TYPE OF WELL: Vapor Monitoring
DRILLING METHOD: Hollow Stem Auger
BIT TYPE: Auger bit

DEPTH FROM SURFACE (FEET)	BLOW COUNT PER 6 IN.	RECOVERY (INCHES)	PID (ppm)	SAMPLE DESIGNATION	WELL DIAGRAM	UNIFIED	LITHOLOGIC CLASSIFICATION AND COMMENTS
0							Flush Mount
1							0-1.5': Cement Grout
2							1.5-2' : Bentonite seal
3							2-11': No. 0 Sand pack
4							
5							
6							Well construction details:
7							0-2.5' : 1" PVC riser
8							2.5-11' : 1" PVC screen
9							
10							
11							
12							End of drilling at 11'; Well set at 11' ; Water not encountered
13							
14							
15							

CASING TYPE/DIAMETER (IN.)
INNER: 1" OUTER: NA

STATIC WATER LEVEL: NA feet below surface
DEPTH WATER ENCOUNTERED: NA feet below surface

SCREENED OR OPEN INTERVAL: 2.5-11
(FEET BELOW SURFACE)

NORTHING /EASTING: 755,255.64 / 490,602.89 ft., msl
GROUND SURFACE ELEVATION: 523.30 ft., msl

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WELL LOG

WELL NUMBER
VP-7
WELL PERMIT NUMBER

PROJECT NAME: Klockner & Klockner
LOCATION: Rockaway, New Jersey
PROJECT NO.: 163292
CONTRACTOR: Goldstar Environmental

START DATE: **08/30/10**
FINISH DATE: **08/30/10**
DRILLER: **Mike Trappett**
LOGGED BY: **SB**

SAMPLER TYPE/DIA.: None
DEPTH TO BEDROCK: NA
TOTAL DEPTH DRILLED: 11 feet
TYPE OF WELL: Vapor Monitoring
DRILLING METHOD: Hollow Stem Auger
BIT TYPE: Auger bit

DEPTH FROM SURFACE (FEET)	BLOW COUNT PER 6 IN.	RECOVERY (INCHES)	PID (ppm)	SAMPLE DESIGNATION	WELL DIAGRAM	UNIFIED	LITHOLOGIC CLASSIFICATION AND COMMENTS
0							Flush Mount
1							0-1.5': Cement Grout Obstruction at 1.5' - offset to west of original location
2							1.5-2' : Bentonite seal
3							2-11': No. 0 Sand pack
4							
5							
6							Well construction details: 0-2.5' : 1" PVC riser 2.5-11' : 1" PVC screen
7							
8							
9							
10							
11							
12							End of drilling at 11'; Well set at 11' ; Water not encountered; Original VP-7 location backfilled
13							
14							
15							

CASING TYPE/DIAMETER (IN.)
INNER: 1" OUTER: NA

STATIC WATER LEVEL: NA feet below surface
DEPTH WATER ENCOUNTERED: NA feet below surface

SCREENED OR OPEN INTERVAL: 2.5-11
(FEET BELOW SURFACE)

NORTHING /EASTING: 755,259.22 / 490,612.48 ft., msl
GROUND SURFACE ELEVATION: 523.60 ft., msl

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WELL LOG

WELL NUMBER
VP-8
WELL PERMIT NUMBER

PROJECT NAME: Klockner & Klockner
LOCATION: Rockaway, New Jersey
PROJECT NO.: 163292
CONTRACTOR: Goldstar Environmental

START DATE: **08/31/10**
FINISH DATE: **08/31/10**
DRILLER: **Mike Trappett**
LOGGED BY: **SB**

SAMPLER TYPE/DIA.: None
DEPTH TO BEDROCK: NA
TOTAL DEPTH DRILLED: 11 feet
TYPE OF WELL: Vapor Monitoring
DRILLING METHOD: Hollow Stem Auger
BIT TYPE: Auger bit

DEPTH FROM SURFACE (FEET)	BLOW COUNT PER 6 IN.	RECOVERY (INCHES)	PID (ppm)	SAMPLE DESIGNATION	WELL DIAGRAM	UNIFIED	LITHOLOGIC CLASSIFICATION AND COMMENTS
0							Flush Mount
1							0-1.5': Cement Grout
2							1.5-2' : Bentonite seal
3							2-11': No. 0 Sand pack VP-8 offset 7' east from original location due to access issues.
4							
5							
6							Well construction details: 0-2.5' : 1" PVC riser
7							2.5-11' : 1" PVC screen
8							
9							
10							
11							
12							End of drilling at 11'; Well set at 11' ; Water not encountered
13							
14							
15							

CASING TYPE/DIAMETER (IN.)
INNER: 1" OUTER: NA

STATIC WATER LEVEL: NA feet below surface
DEPTH WATER ENCOUNTERED: NA feet below surface

SCREENED OR OPEN INTERVAL: 2.5-11
(FEET BELOW SURFACE)

NORTHING /EASTING: 755,255.09 / 490,632.87 ft., msl
GROUND SURFACE ELEVATION: 523.90 ft., msl

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WELL LOG

WELL NUMBER
VP-9
WELL PERMIT NUMBER

PROJECT NAME: Klockner & Klockner
LOCATION: Rockaway, New Jersey
PROJECT NO.: 163292
CONTRACTOR: Goldstar Environmental

START DATE: **08/30/10**
FINISH DATE: **08/30/10**
DRILLER: **Mike Trappett**
LOGGED BY: **SB**

SAMPLER TYPE/DIA.: None
DEPTH TO BEDROCK: NA
TOTAL DEPTH DRILLED: 11 feet
TYPE OF WELL: Vapor Monitoring
DRILLING METHOD: Hollow Stem Auger
BIT TYPE: Auger bit

DEPTH FROM SURFACE (FEET)	BLOW COUNT PER 6 IN.	RECOVERY (INCHES)	PID (ppm)	SAMPLE DESIGNATION	WELL DIAGRAM	UNIFIED	LITHOLOGIC CLASSIFICATION AND COMMENTS
0							Flush Mount
1							0-1.5': Cement Grout
2							1.5-2' : Bentonite seal
3							2-11': No. 0 Sand pack
4							
5							
6							Well construction details:
7							0-2.5' : 1" PVC riser
8							2.5-11' : 1" PVC screen
9							
10							
11							
12							End of drilling at 11'; Well set at 11' ; Water not encountered
13							
14							
15							

CASING TYPE/DIAMETER (IN.)
INNER: 1" OUTER: NA

STATIC WATER LEVEL: NA feet below surface
DEPTH WATER ENCOUNTERED: NA feet below surface

SCREENED OR OPEN INTERVAL: 2.5-11
(FEET BELOW SURFACE)

NORTHING /EASTING: 755,236.67 / 490,638.59 ft., msl
GROUND SURFACE ELEVATION: 523.40 ft., msl

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WELL LOG

WELL NUMBER
VP-10
WELL PERMIT NUMBER

PROJECT NAME: Klockner & Klockner
LOCATION: Rockaway, New Jersey
PROJECT NO.: 163292
CONTRACTOR: Goldstar Environmental

START DATE: **08/25/10**
FINISH DATE: **08/25/10**
DRILLER: **Mike Trappett**
LOGGED BY: **RB**

SAMPLER TYPE/DIA.: None
DEPTH TO BEDROCK: NA
TOTAL DEPTH DRILLED: 11 feet
TYPE OF WELL: Vapor Monitoring
DRILLING METHOD: Hollow Stem Auger
BIT TYPE: Auger bit

DEPTH FROM SURFACE (FEET)	BLOW COUNT PER 6 IN.	RECOVERY (INCHES)	PID (ppm)	SAMPLE DESIGNATION	WELL DIAGRAM	UNIFIED	LITHOLOGIC CLASSIFICATION AND COMMENTS
0							Flush Mount
1							0-1.5': Cement Grout
2							1.5-2' : Bentonite seal
3							2-11': No. 0 Sand pack
4							Refusal at 4'; Offset 2' north of original location, continue drilling to 11'
5							
6							Well construction details:
7							0-2.5' : 1" PVC riser
8							2.5-11' : 1" PVC screen
9							
10							
11							
12							End of drilling at 11'; Well set at 11' ; Water not encountered
13							
14							
15							

CASING TYPE/DIAMETER (IN.)
INNER: 1" OUTER: NA

STATIC WATER LEVEL: NA feet below surface
DEPTH WATER ENCOUNTERED: NA feet below surface

SCREENED OR OPEN INTERVAL: 2.5-11
(FEET BELOW SURFACE)

NORTHING /EASTING: 755,230.46 / 490,646.88 ft., msl
GROUND SURFACE ELEVATION: 523.50 ft., msl

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WELL LOG

WELL NUMBER
VP-11
WELL PERMIT NUMBER

PROJECT NAME: Klockner & Klockner
LOCATION: Rockaway, New Jersey
PROJECT NO.: 163292
CONTRACTOR: Goldstar Environmental

START DATE: **08/25/10**
FINISH DATE: **08/25/10**
DRILLER: **Mike Trappett**
LOGGED BY: **RB**

SAMPLER TYPE/DIA.: None
NORTHING:
TYPE OF WELL: Vapor Monitoring
DEPTH TO BEDROCK: NA
EASTING:
DRILLING METHOD: Hollow Stem Auger
TOTAL DEPTH DRILLED: 11 feet
BIT TYPE: Auger bit

DEPTH FROM SURFACE (FEET)	BLOW COUNT PER 6 IN.	RECOVERY (INCHES)	PID (ppm)	SAMPLE DESIGNATION	WELL DIAGRAM	UNIFIED	LITHOLOGIC CLASSIFICATION AND COMMENTS
0							Flush Mount
1							0-1.5': Cement Grout
2							1.5-2' : Bentonite seal
3							2-11': No. 0 Sand pack
4							
5							
6							Well construction details:
7							0-2.5' : 1" PVC riser
8							2.5-11' : 1" PVC screen
9							
10							
11							
12							End of drilling at 11'; Well set at 11' ; Water not encountered
13							
14							
15							

CASING TYPE/DIAMETER (IN.)
INNER: 1" OUTER: NA

STATIC WATER LEVEL: NA feet below surface
DEPTH WATER ENCOUNTERED: NA feet below surface

SCREENED OR OPEN INTERVAL: 2.5-11
(FEET BELOW SURFACE)

NORTHING /EASTING: 755,227.58 / 490,651.29 ft., msl
GROUND SURFACE ELEVATION: 523.70 ft., msl

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WELL LOG

WELL NUMBER

VP-12

WELL PERMIT NUMBER

PROJECT NAME: Klockner & Klockner **LOCATION:** Rockaway, New Jersey

PROJECT NO.: 163292 **CONTRACTOR:** Goldstar Environmental

START DATE: **08/31/10**

FINISH DATE: **08/31/10**

DRILLER: **Mike Trappett**

LOGGED BY: **SB**

SAMPLER TYPE/DIA.: None **TYPE OF WELL:** Vapor Monitoring

DEPTH TO BEDROCK: NA **DRILLING METHOD:** Hollow Stem Auger

TOTAL DEPTH DRILLED: 11 feet **BIT TYPE:** Auger bit

DEPTH FROM SURFACE (FEET)	BLOW COUNT PER 6 IN.	RECOVERY (INCHES)	PID (ppm)	SAMPLE DESIGNATION	WELL DIAGRAM	UNIFIED	LITHOLOGIC CLASSIFICATION AND COMMENTS
0							Flush Mount
1							0-1.5': Cement Grout
2							1.5-2' : Bentonite seal
3							2-11': No. 0 Sand pack
4							
5							
6							Well construction details:
7							0-2.5' : 1" PVC riser
8							2.5-11' : 1" PVC screen
9							
10							
11							
12							End of drilling at 11'; Well set at 11' ; Water not encountered
13							
14							
15							

CASING TYPE/DIAMETER (IN.)

INNER: 1" OUTER: NA

STATIC WATER LEVEL: NA feet below surface

DEPTH WATER ENCOUNTERED: NA feet below surface

SCREENED OR OPEN INTERVAL: 2.5-11
(FEET BELOW SURFACE)

NORTHING /EASTING: 755,230.33 / 490,653.93 ft., msl

GROUND SURFACE ELEVATION: 523.90 ft., msl

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WELL LOG

WELL NUMBER
VP-13
WELL PERMIT NUMBER

PROJECT NAME: Klockner & Klockner
LOCATION: Rockaway, New Jersey
PROJECT NO.: 163292
CONTRACTOR: Goldstar Environmental

START DATE: **08/30/10**
FINISH DATE: **08/30/10**
DRILLER: **Mike Trappett**
LOGGED BY: **SB**

SAMPLER TYPE/DIA.: None
DEPTH TO BEDROCK: NA
TOTAL DEPTH DRILLED: 11 feet
TYPE OF WELL: Vapor Monitoring
DRILLING METHOD: Hollow Stem Auger
BIT TYPE: Auger bit

DEPTH FROM SURFACE (FEET)	BLOW COUNT PER 6 IN.	RECOVERY (INCHES)	PID (ppm)	SAMPLE DESIGNATION	WELL DIAGRAM	UNIFIED	LITHOLOGIC CLASSIFICATION AND COMMENTS
0							Flush Mount
1							0-1.5': Cement Grout
2							1.5-2' : Bentonite seal
3							2-11': No. 0 Sand pack Large void at 3'- 8 bags of sand to fill; Well re-drilled on 8/30/10 with 6" augers
4							
5							
6							Well construction details: 0-2.5' : 1" PVC riser
7							2.5-11' : 1" PVC screen
8							
9							
10							
11							
12							End of drilling at 11'; Well set at 11' ; Water not encountered
13							
14							
15							

CASING TYPE/DIAMETER (IN.)
INNER: 1" OUTER: NA

STATIC WATER LEVEL: NA feet below surface
DEPTH WATER ENCOUNTERED: NA feet below surface

SCREENED OR OPEN INTERVAL: 2.5-11
(FEET BELOW SURFACE)

NORTHING /EASTING: 755,225.27 / 490,627.17 ft., msl
GROUND SURFACE ELEVATION: 522.70 ft., msl

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WELL LOG

WELL NUMBER
VP-14
WELL PERMIT NUMBER

PROJECT NAME: Klockner & Klockner
LOCATION: Rockaway, New Jersey
PROJECT NO.: 163292
CONTRACTOR: Goldstar Environmental

START DATE: **08/25/10**
FINISH DATE: **08/25/10**
DRILLER: **Mike Trappett**
LOGGED BY: **RB**

SAMPLER TYPE/DIA.: None
DEPTH TO BEDROCK: NA
TOTAL DEPTH DRILLED: 15 feet
TYPE OF WELL: Vapor Monitoring
DRILLING METHOD: Hollow Stem Auger
BIT TYPE: Auger bit

DEPTH FROM SURFACE (FEET)	BLOW COUNT PER 6 IN.	RECOVERY (INCHES)	PID (ppm)	SAMPLE DESIGNATION	WELL DIAGRAM	UNIFIED	LITHOLOGIC CLASSIFICATION AND COMMENTS
0							Flush Mount
1							0-1.5': Cement Grout
2							1.5-2' : Bentonite seal
3							2-11': No. 0 Sand pack
4							
5							
6							Well construction details:
7							0-2.5' : 1" PVC riser
8							2.5-11' : 1" PVC screen
9							
10							
11							
12							Well set at 11'
13							Static DTW at 11.8'
14							
15							End of drilling at 15'

CASING TYPE/DIAMETER (IN.)
INNER: 1" OUTER: NA

STATIC WATER LEVEL: 11.8 (8/25/10) feet below surface
DEPTH WATER ENCOUNTERED: 12.16 feet below surface

SCREENED OR OPEN INTERVAL: 2.5-11
(FEET BELOW SURFACE)

NORTHING /EASTING: 755,205.38 / 490,630.69 ft., msl
GROUND SURFACE ELEVATION: 522.70 ft., msl

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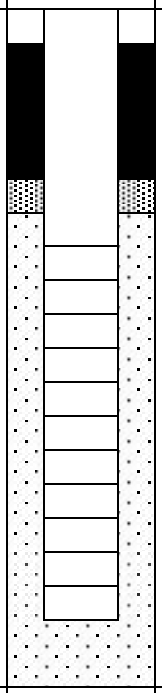
WELL LOG

WELL NUMBER
VP-15
WELL PERMIT NUMBER

PROJECT NAME: Klockner & Klockner
LOCATION: Rockaway, New Jersey
PROJECT NO.: 163292
CONTRACTOR: ECDI

START DATE: **11/05/12**
FINISH DATE: **11/05/12**
DRILLER: **Steve Moylan**
LOGGED BY: **K. Lau**

SAMPLER TYPE/DIA.: NA
TYPE OF WELL: Monitoring
DEPTH TO BEDROCK: NA
DRILLING METHOD: Direct Push
TOTAL DEPTH DRILLED: 10 feet
BIT TYPE: Prepoint probe tip

DEPTH FROM SURFACE (FEET)	BLOW COUNT PER 6 IN.	RECOVERY (INCHES)	PID (ppm)	SAMPLE DESIGNATION	WELL DIAGRAM	UNIFIED	LITHOLOGIC CLASSIFICATION AND COMMENTS
0							Flush Mount
1–10							Soil cuttings were not produced, therefore lithology was not recorded.
11–15							End of boring at 10 feet below surface.

Well Construction Details

0 to 3.5 ft. below surface - 1" diameter PVC riser
3.5 to 9 ft. below surface - 1" diameter 10 slot PVC screen
0.5 to 2.5 ft. below surface - Portland cement/Bentonix mix
2.5 to 3.0 ft. below surface - Bentonite seal
3.0 to 10 ft. below surface - No. 0 sand

CASING TYPE/DIAMETER (IN.)
INNER: 1 OUTER: NA

STATIC WATER LEVEL: NA feet below surface
DEPTH WATER ENCOUNTERED: NA feet below surface

SCREENED OR OPEN INTERVAL: 3.5 to 9
(FEET BELOW SURFACE)

NORTHING /EASTING: 755,112 / 490515 ft., msl
GROUND SURFACE ELEVATION: 522.90 ft., msl

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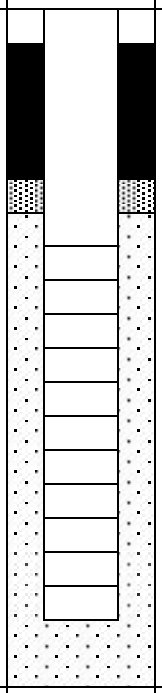
WELL LOG

WELL NUMBER
VP-16
WELL PERMIT NUMBER

PROJECT NAME: Klockner & Klockner
LOCATION: Rockaway, New Jersey
PROJECT NO.: 163292
CONTRACTOR: ECDI

START DATE: **11/06/12**
FINISH DATE: **11/06/12**
DRILLER: **Steve Moylan**
LOGGED BY: **K. Lau**

SAMPLER TYPE/DIA.: NA
DEPTH TO BEDROCK: NA
TOTAL DEPTH DRILLED: 10 feet
TYPE OF WELL: Monitoring
DRILLING METHOD: Direct Push
BIT TYPE: Prepoint probe tip

DEPTH FROM SURFACE (FEET)	BLOW COUNT PER 6 IN.	RECOVERY (INCHES)	PID (ppm)	SAMPLE DESIGNATION	WELL DIAGRAM	UNIFIED	LITHOLOGIC CLASSIFICATION AND COMMENTS
0							Flush Mount
1–10							Soil cuttings were not produced, therefore lithology was not recorded.
11–15							End of boring at 10 feet below surface.

Well Construction Details
0 to 3.5 ft. below surface - 1" diameter PVC riser
3.5 to 9 ft. below surface - 1" diameter 10 slot PVC screen
0.5 to 2.5 ft. below surface - Portland cement/Bentonix mix
2.5 to 3.0 ft. below surface - Bentonite seal
3.0 to 10 ft. below surface - No. 0 sand

CASING TYPE/DIAMETER (IN.)
INNER: 1 OUTER: NA

STATIC WATER LEVEL: NA feet below surface
DEPTH WATER ENCOUNTERED: NA feet below surface

SCREENED OR OPEN INTERVAL: 3.5 to 9
(FEET BELOW SURFACE)

NORTHING /EASTING: 755,167 / 490,534 ft., msl
GROUND SURFACE ELEVATION: 522.90 ft., msl

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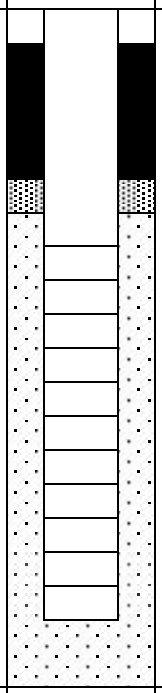
WELL LOG

WELL NUMBER
VP-17
WELL PERMIT NUMBER

PROJECT NAME: Klockner & Klockner
LOCATION: Rockaway, New Jersey
PROJECT NO.: 163292
CONTRACTOR: ECDI

START DATE: **11/09/12**
FINISH DATE: **11/09/12**
DRILLER: **Steve Moylan**
LOGGED BY: **K. Lau**

SAMPLER TYPE/DIA.: NA
TYPE OF WELL: Monitoring
DEPTH TO BEDROCK: NA
DRILLING METHOD: Direct Push
TOTAL DEPTH DRILLED: 10 feet
BIT TYPE: Prepoint probe tip

DEPTH FROM SURFACE (FEET)	BLOW COUNT PER 6 IN.	RECOVERY (INCHES)	PID (ppm)	SAMPLE DESIGNATION	WELL DIAGRAM	UNIFIED	LITHOLOGIC CLASSIFICATION AND COMMENTS
0							Flush Mount
1–10							Soil cuttings were not produced, therefore lithology was not recorded.
11–15							End of boring at 10 feet below surface.

Well Construction Details
0 to 3.5 ft. below surface - 1" diameter PVC riser
3.5 to 9 ft. below surface - 1" diameter 10 slot PVC screen
0.5 to 2.5 ft. below surface - Portland cement/Bentonix mix
2.5 to 3.0 ft. below surface - Bentonite seal
3.0 to 10 ft. below surface - No. 0 sand

CASING TYPE/DIAMETER (IN.)
INNER: 1 OUTER: NA

STATIC WATER LEVEL: NA feet below surface
DEPTH WATER ENCOUNTERED: NA feet below surface

SCREENED OR OPEN INTERVAL: 3.5 to 9
(FEET BELOW SURFACE)

NORTHING /EASTING: 755,228 / 490,546 ft., msl
GROUND SURFACE ELEVATION: 522.90 ft., msl

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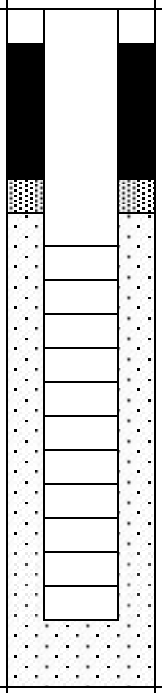
WELL LOG

WELL NUMBER
VP-18
WELL PERMIT NUMBER

PROJECT NAME: Klockner & Klockner
LOCATION: Rockaway, New Jersey
PROJECT NO.: 163292
CONTRACTOR: ECDI

START DATE: **11/08/12**
FINISH DATE: **11/08/12**
DRILLER: **Steve Moylan**
LOGGED BY: **K. Lau**

SAMPLER TYPE/DIA.: NA
TYPE OF WELL: Monitoring
DEPTH TO BEDROCK: NA
DRILLING METHOD: Direct Push
TOTAL DEPTH DRILLED: 10 feet
BIT TYPE: Prepoint probe tip

DEPTH FROM SURFACE (FEET)	BLOW COUNT PER 6 IN.	RECOVERY (INCHES)	PID (ppm)	SAMPLE DESIGNATION	WELL DIAGRAM	UNIFIED	LITHOLOGIC CLASSIFICATION AND COMMENTS
0							Flush Mount
1							Soil cuttings were not produced, therefore lithology was not recorded.
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							End of boring at 10 feet below surface.
12							Well Construction Details 0 to 3.5 ft. below surface - 1" diameter PVC riser
13							3.5 to 9 ft. below surface - 1" diameter 10 slot PVC screen 0.5 to 2.5 ft. below surface - Portland cement/Bentonix mix
14							2.5 to 3.0 ft. below surface - Bentonite seal 3.0 to 10 ft. below surface - No. 0 sand
15							

CASING TYPE/DIAMETER (IN.)
INNER: 1 OUTER: NA

STATIC WATER LEVEL: NA feet below surface
DEPTH WATER ENCOUNTERED: NA feet below surface

SCREENED OR OPEN INTERVAL: 3.5 to 9
(FEET BELOW SURFACE)

NORTHING /EASTING: 755,080 / 490,574 ft., msl
GROUND SURFACE ELEVATION: 522.90 ft., msl

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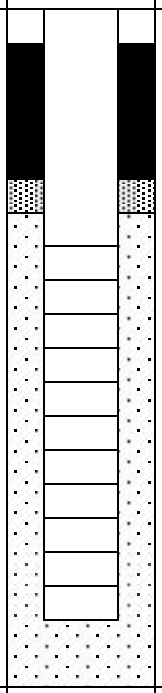
WELL LOG

WELL NUMBER
VP-19
WELL PERMIT NUMBER

PROJECT NAME: Klockner & Klockner
LOCATION: Rockaway, New Jersey
PROJECT NO.: 163292
CONTRACTOR: ECDI

START DATE: **11/02/12**
FINISH DATE: **11/02/12**
DRILLER: **Steve Moylan**
LOGGED BY: **K. Lau**

SAMPLER TYPE/DIA.: NA
TYPE OF WELL: Monitoring
DEPTH TO BEDROCK: NA
DRILLING METHOD: Direct Push
TOTAL DEPTH DRILLED: 10 feet
BIT TYPE: Prepoint probe tip

DEPTH FROM SURFACE (FEET)	BLOW COUNT PER 6 IN.	RECOVERY (INCHES)	PID (ppm)	SAMPLE DESIGNATION	WELL DIAGRAM	UNIFIED	LITHOLOGIC CLASSIFICATION AND COMMENTS
0							Flush Mount
1–10							Soil cuttings were not produced, therefore lithology was not recorded.
11–15							End of boring at 10 feet below surface.

Well Construction Details

0 to 3.5 ft. below surface - 1" diameter PVC riser
3.5 to 9 ft. below surface - 1" diameter 10 slot PVC screen
0.5 to 2.5 ft. below surface - Portland cement/Bentonix mix
2.5 to 3.0 ft. below surface - Bentonite seal
3.0 to 10 ft. below surface - No. 0 sand

CASING TYPE/DIAMETER (IN.)
INNER: 1 OUTER: NA

STATIC WATER LEVEL: NA feet below surface
DEPTH WATER ENCOUNTERED: NA feet below surface

SCREENED OR OPEN INTERVAL: 3.5 to 9
(FEET BELOW SURFACE)

NORTHING /EASTING: 755,125 / 490,586 ft., msl
GROUND SURFACE ELEVATION: 522.90 ft., msl

TRC Environmental Corporation
57 E. Willow Street, Millburn, NJ 07041 (973) 564-6006

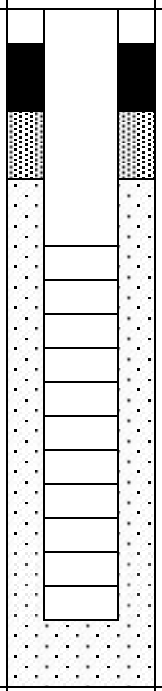
WELL LOG

WELL NUMBER
VP-20
WELL PERMIT NUMBER

PROJECT NAME: Klockner & Klockner
LOCATION: Rockaway, New Jersey
PROJECT NO.: 163292
CONTRACTOR: ECDI

START DATE: **11/05/12**
FINISH DATE: **11/06/12**
DRILLER: **Steve Moylan**
LOGGED BY: **K. Lau**

SAMPLER TYPE/DIA.: NA
DEPTH TO BEDROCK: NA
TOTAL DEPTH DRILLED: 10 feet
TYPE OF WELL: Monitoring
DRILLING METHOD: Direct Push
BIT TYPE: Prepoint probe tip

DEPTH FROM SURFACE (FEET)	BLOW COUNT PER 6 IN.	RECOVERY (INCHES)	PID (ppm)	SAMPLE DESIGNATION	WELL DIAGRAM	UNIFIED	LITHOLOGIC CLASSIFICATION AND COMMENTS
0							Flush Mount
1–10							Soil cuttings were not produced, therefore lithology was not recorded.
11–15							End of boring at 10 feet below surface.

Well Construction Details
0 to 3.5 ft. below surface - 1" diameter PVC riser
3.5 to 9 ft. below surface - 1" diameter 10 slot PVC screen
0.5 to 1.5 ft. below surface - Portland cement/Bentonix mix
1.5 to 2.5 ft. below surface - Bentonite seal
2.5 to 10 ft. below surface - No. 0 sand

CASING TYPE/DIAMETER (IN.)
INNER: 1 OUTER: NA

STATIC WATER LEVEL: NA feet below surface
DEPTH WATER ENCOUNTERED: NA feet below surface

SCREENED OR OPEN INTERVAL: 3.5 to 9
(FEET BELOW SURFACE)

NORTHING /EASTING: 755,167 / 490,569 ft., msl
GROUND SURFACE ELEVATION: 522.80 ft., msl

TRC Environmental Corporation
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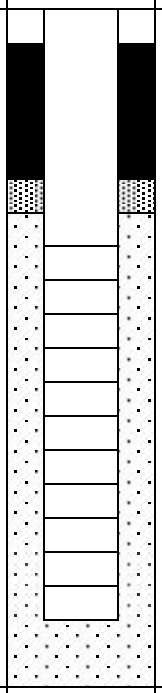
WELL LOG

WELL NUMBER
VP-21
WELL PERMIT NUMBER

PROJECT NAME: Klockner & Klockner
LOCATION: Rockaway, New Jersey
PROJECT NO.: 163292
CONTRACTOR: ECDI

START DATE: **11/01/12**
FINISH DATE: **11/01/12**
DRILLER: **Steve Moylan**
LOGGED BY: **K. Lau**

SAMPLER TYPE/DIA.: NA
TYPE OF WELL: Monitoring
DEPTH TO BEDROCK: NA
DRILLING METHOD: Direct Push
TOTAL DEPTH DRILLED: 10 feet
BIT TYPE: Prepoint probe tip

DEPTH FROM SURFACE (FEET)	BLOW COUNT PER 6 IN.	RECOVERY (INCHES)	PID (ppm)	SAMPLE DESIGNATION	WELL DIAGRAM	UNIFIED	LITHOLOGIC CLASSIFICATION AND COMMENTS
0							Flush Mount
1–10							Soil cuttings were not produced, therefore lithology was not recorded.
11–15							End of boring at 10 feet below surface.

Well Construction Details
0 to 3.5 ft. below surface - 1" diameter PVC riser
3.5 to 9 ft. below surface - 1" diameter 10 slot PVC screen
0.5 to 2.5 ft. below surface - Portland cement/Bentonix mix
2.5 to 3.0 ft. below surface - Bentonite seal
3.0 to 10 ft. below surface - No. 0 sand

CASING TYPE/DIAMETER (IN.)
INNER: 1 OUTER: NA

STATIC WATER LEVEL: NA feet below surface
DEPTH WATER ENCOUNTERED: NA feet below surface

SCREENED OR OPEN INTERVAL: 3.5 to 9
(FEET BELOW SURFACE)

NORTHING /EASTING: 755,215 / 490,604 ft., msl
GROUND SURFACE ELEVATION: 522.90 ft., msl

TRC Environmental Corporation
57 E. Willow Street, Millburn, NJ 07041 (973) 564-6006

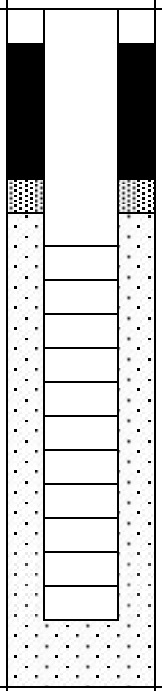
WELL LOG

WELL NUMBER
VP-22
WELL PERMIT NUMBER

PROJECT NAME: Klockner & Klockner
LOCATION: Rockaway, New Jersey
PROJECT NO.: 163292
CONTRACTOR: ECDI

START DATE: **11/05/12**
FINISH DATE: **11/05/12**
DRILLER: **Steve Moylan**
LOGGED BY: **K. Lau**

SAMPLER TYPE/DIA.: NA
TYPE OF WELL: Monitoring
DEPTH TO BEDROCK: NA
DRILLING METHOD: Direct Push
TOTAL DEPTH DRILLED: 10 feet
BIT TYPE: Prepoint probe tip

DEPTH FROM SURFACE (FEET)	BLOW COUNT PER 6 IN.	RECOVERY (INCHES)	PID (ppm)	SAMPLE DESIGNATION	WELL DIAGRAM	UNIFIED	LITHOLOGIC CLASSIFICATION AND COMMENTS
0							Flush Mount
1–10							Soil cuttings were not produced, therefore lithology was not recorded.
11–15							End of boring at 10 feet below surface. Well Construction Details 0 to 3.5 ft. below surface - 1" diameter PVC riser 3.5 to 9 ft. below surface - 1" diameter 10 slot PVC screen 0.5 to 2.5 ft. below surface - Portland cement/Bentonix mix 2.5 to 3.0 ft. below surface - Bentonite seal 3.0 to 10 ft. below surface - No. 0 sand

CASING TYPE/DIAMETER (IN.)
INNER: 1 OUTER: NA

STATIC WATER LEVEL: NA feet below surface
DEPTH WATER ENCOUNTERED: NA feet below surface

SCREENED OR OPEN INTERVAL: 3.5 to 9
(FEET BELOW SURFACE)

NORTHING /EASTING: 755,072 / 490,655 ft., msl
GROUND SURFACE ELEVATION: 522.90 ft., msl

TRC Environmental Corporation
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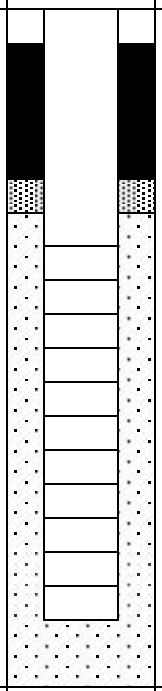
WELL LOG

WELL NUMBER
VP-23
WELL PERMIT NUMBER

PROJECT NAME: Klockner & Klockner
LOCATION: Rockaway, New Jersey
PROJECT NO.: 163292
CONTRACTOR: ECDI

START DATE: **11/14/12**
FINISH DATE: **11/14/12**
DRILLER: **Steve Moylan**
LOGGED BY: **K. Lau**

SAMPLER TYPE/DIA.: NA
TYPE OF WELL: Monitoring
DEPTH TO BEDROCK: NA
DRILLING METHOD: Direct Push
TOTAL DEPTH DRILLED: 10 feet
BIT TYPE: Prepoint probe tip

DEPTH FROM SURFACE (FEET)	BLOW COUNT PER 6 IN.	RECOVERY (INCHES)	PID (ppm)	SAMPLE DESIGNATION	WELL DIAGRAM	UNIFIED	LITHOLOGIC CLASSIFICATION AND COMMENTS
0							Flush Mount
1–10							Soil cuttings were not produced, therefore lithology was not recorded.
11–15							End of boring at 10 feet below surface.

Well Construction Details
0 to 3.5 ft. below surface - 1" diameter PVC riser
3.5 to 9 ft. below surface - 1" diameter 10 slot PVC screen
0.5 to 2.5 ft. below surface - Portland cement/Bentonix mix
2.5 to 3.0 ft. below surface - Bentonite seal
3.0 to 10 ft. below surface - No. 0 sand

CASING TYPE/DIAMETER (IN.)
INNER: 1 OUTER: NA

STATIC WATER LEVEL: NA feet below surface
DEPTH WATER ENCOUNTERED: NA feet below surface

SCREENED OR OPEN INTERVAL: 3.5 to 9
(FEET BELOW SURFACE)

NORTHING /EASTING: 755,134 / 490,614 ft., msl
GROUND SURFACE ELEVATION: 522.90 ft., msl

TRC Environmental Corporation
57 E. Willow Street, Millburn, NJ 07041 (973) 564-6006

WELL LOG

WELL NUMBER
VP-24
WELL PERMIT NUMBER

PROJECT NAME: Klockner & Klockner
LOCATION: Rockaway, New Jersey
PROJECT NO.: 163292
CONTRACTOR: Goldstar

START DATE: **02/14/13**
FINISH DATE: **02/14/13**
DRILLER: **Mike**
LOGGED BY: **C. Georgiadis**

SAMPLER TYPE/DIA.: NA
TYPE OF WELL: VP
DEPTH TO BEDROCK: NA
DRILLING METHOD: Hollow Stem Auger
TOTAL DEPTH DRILLED: 10 feet
BIT TYPE: Auger Bit

DEPTH FROM SURFACE (FEET)	BLOW COUNT PER 6 IN.	RECOVERY (INCHES)	PID (ppm)	SAMPLE DESIGNATION	WELL DIAGRAM	UNIFIED	LITHOLOGIC CLASSIFICATION AND COMMENTS
0							Flush Mount
1			0				0 to 2"- Not backfilled; will be paved 0"-3" with asphalt
2							2" to 3.5' - Clean fill DGA from excavation activities
3							
4							
5							
6			0				3.5 to 8' - Brown-tan fine SAND, little fine gravel.
7							
8							
9			0				8 to 10' - Brown fine to medium SAND.
10							
11							End of boring at 10 feet below surface.
12							Well Construction Details
13							0 to 4 ft. below surface - 1" diameter PVC riser 4 to 9 ft. below surface - 1" diameter 10 slot PVC screen 0.5 to 3 ft. below surface - Portland cement/Bentonix mix
14							3 to 3.5 ft. below surface - Bentonite seal 3.5 to 10 ft. below surface - No. 0 sand
15							

CASING TYPE/DIAMETER (IN.)
INNER: 1 OUTER: NA

STATIC WATER LEVEL: NA feet below surface
DEPTH WATER ENCOUNTERED: NA feet below surface

SCREENED OR OPEN INTERVAL: 4 to 9
(FEET BELOW SURFACE)

NORTHING /EASTING: 755,177/490,625 ft., msl
GROUND SURFACE ELEVATION: 522.33 ft., msl

TRC Job No. 163292
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TRC Environmental Corporation
57 E. Willow Street, Millburn, NJ 07041 (973) 564-6006

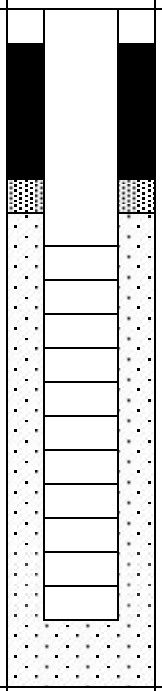
WELL LOG

WELL NUMBER
VP-25
WELL PERMIT NUMBER

PROJECT NAME: Klockner & Klockner
LOCATION: Rockaway, New Jersey
PROJECT NO.: 163292
CONTRACTOR: ECDI

START DATE: **11/13/12**
FINISH DATE: **11/13/12**
DRILLER: **Steve Moylan**
LOGGED BY: **K. Lau**

SAMPLER TYPE/DIA.: NA
TYPE OF WELL: Monitoring
DEPTH TO BEDROCK: NA
DRILLING METHOD: Direct Push
TOTAL DEPTH DRILLED: 10 feet
BIT TYPE: Prepoint probe tip

DEPTH FROM SURFACE (FEET)	BLOW COUNT PER 6 IN.	RECOVERY (INCHES)	PID (ppm)	SAMPLE DESIGNATION	WELL DIAGRAM	UNIFIED	LITHOLOGIC CLASSIFICATION AND COMMENTS
0							Flush Mount
1–10							Soil cuttings were not produced, therefore lithology was not recorded.
11–15							End of boring at 10 feet below surface.

Well Construction Details
0 to 3.5 ft. below surface - 1" diameter PVC riser
3.5 to 9 ft. below surface - 1" diameter 10 slot PVC screen
0.5 to 2.5 ft. below surface - Portland cement/Bentonix mix
2.5 to 3.0 ft. below surface - Bentonite seal
3.0 to 10 ft. below surface - No. 0 sand

CASING TYPE/DIAMETER (IN.)
INNER: 1 OUTER: NA

STATIC WATER LEVEL: NA feet below surface
DEPTH WATER ENCOUNTERED: NA feet below surface

SCREENED OR OPEN INTERVAL: 3.5 to 9
(FEET BELOW SURFACE)

NORTHING /EASTING: 755,284 / 490,657 ft., msl
GROUND SURFACE ELEVATION: 523.00 ft., msl

APPENDIX E

BLOWER OWNER'S MANUAL

Spencer® Vortex® Regenerative Blowers

Serial No:	7003001
Model No:	VB075B-10H

Installation, Operation and Maintenance Instructions

VB007

VB055

Important

Read and become familiar with this manual prior to uncrating and installing your Spencer Vortex Blower. Following the instructions detailed here will help you realize its full potential of efficient service and extended lifespan. Damage resulting from failure to follow correct procedure will void the warranty.

Contents

I. General

Scope
Information contained in this manual relates to Vortex Blowers standard and explosion-proof motor models VB001S, VB001, VB002S, VB002, VB003S, VB003, VB004S, VB004, VB007S, VB007, VB019S, VB019, VB030S, VB030, VB037S, VB037, VB055, VB075, and VB110.

Limited Warranty
We warrant that this product will be free from defects in material and workmanship for a period of 18 months from date of shipment or 12 months from date of startup, whichever comes first. Within the warranty period, we shall repair or replace F.O.B. our Factory such products that are determined by us to be defective.

This warranty will not apply to any product which has been subjected to misuse, negligence, or accident, or misapplied or improperly installed. This warranty will not apply to any product which has been disassembled, repaired, or otherwise altered by any persons not authorized by the Spencer Vortex Service Department.

On units which include thermal protection, the thermal protection must be connected as recommended.

The guarantee of the motor and control manufacturers will govern the extent of our guarantee on such equipment. Warranty work on motors and controls must be authorized by Spencer and must be performed in an authorized shop as designated by the manufacturers.

The Spencer Turbine Company reserves the right to invoice all expenses incurred when repairs are made in the field at the specific request of the customer.

No assemblies or parts of assemblies will be accepted for repair or replacement under this warranty without prior authorization by The Spencer Turbine Company. For complete warranty information, obtain Spencer's Form 706, "Terms and Conditions of Sales."

Safety Precautions
Power sources, protective devices, and grounding provisions must be in accordance with wiring instructions provided in this manual.

Blower becomes hot during operation and may cause burns if touched.

Do not operate the blower under load conditions which exceed the rated full-load amps on the nameplate.

Do not install the blower in any area which may have an explosive atmosphere or which may contain flammable gases or liquids. Always provide proper ventilation. Do not install in any area which may subject the blower to corrosive liquids. Excessive moisture may cause electrical failure; install the blower in areas free from water or rain. Do not operate blower without motor cooling fan cover, or without impeller end cover.

Before installing blowers with explosion-proof motors, the buyer must check federal, state and local codes to see if such motors are appropriate for the intended application environment. It is the buyer's responsibility to determine the suitability of any product for a particular purpose.

Storage
If machine is to be stored for an extended period of time, it must be carefully protected from dampness and dirt.

II. Installation

Locating, Mounting, Connecting
Ambient temperature at the installed location should not be less than -5˚ F or greater than 104˚ F. Relative humidity should not exceed 80%.

Mount the blower in a horizontal or vertical position as shown in Figure 1. For models VB055, VB075 and VB110, it is recommended to mount in the horizontal position only. Check with factory *prior* to mounting these models vertically.

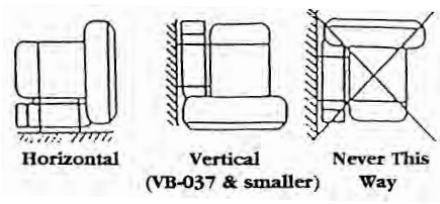


Fig. 1 Mounting Positions

Remove protective coverings, such as vinyl tape or plastic plugs, from the inlet and outlet ports. Models VB001, VB002 and VB003 are supplied with a patented (U.S. Patent 5,791,870) reversible flange with threaded pipe or tubing connections. Avoid excessive stress caused by pipe connector tightening or by misaligned pipe on the inlet and outlet ports. Support piping by brackets or other means.

In the event the blower is located where dust, fibers, drops of water, or other particulates may be in the airstream, use a filter on the suction side of the piping. If foreign matter enters the impeller, it may clog, jam, or otherwise impair the blower performance.

Wiring

Caution: Confirm that the power source is the same as that indicated on the unit's nameplate. Application of incorrect voltage or improper phase connection may cause motor failure or other damage.

Use conductors and devices (such as the circuit breakers, starters, and switches shown in Figure 3) that are suitable for the applications shown in Tables 1 and 2 and are in compliance with the National Electric Code and applicable local codes and regulations. Motor terminal connections are shown below Table 1.

Provide protection from overheating of the motor windings. Some models are equipped with built-in thermal protectors (see Table 1). Where applicable, connect the leads from the pilot-duty thermal protector to the magnetic starter as shown in Fig. 3.

Check the direction of rotation of the blower.
To reverse the direction or rotation:

1) for a single-phase motor, interchange motor leads 5 and 8.
2) for a three-phase motor, interchange any two of the three line connections.

Caution: Install a properly-sized overload device and disconnect in accordance with local codes and regulations and dedicated only to the Vortex Blower.

Furnish the Vortex Blower and all associated electrical devices with a proper ground in accordance with all local codes and regulations.

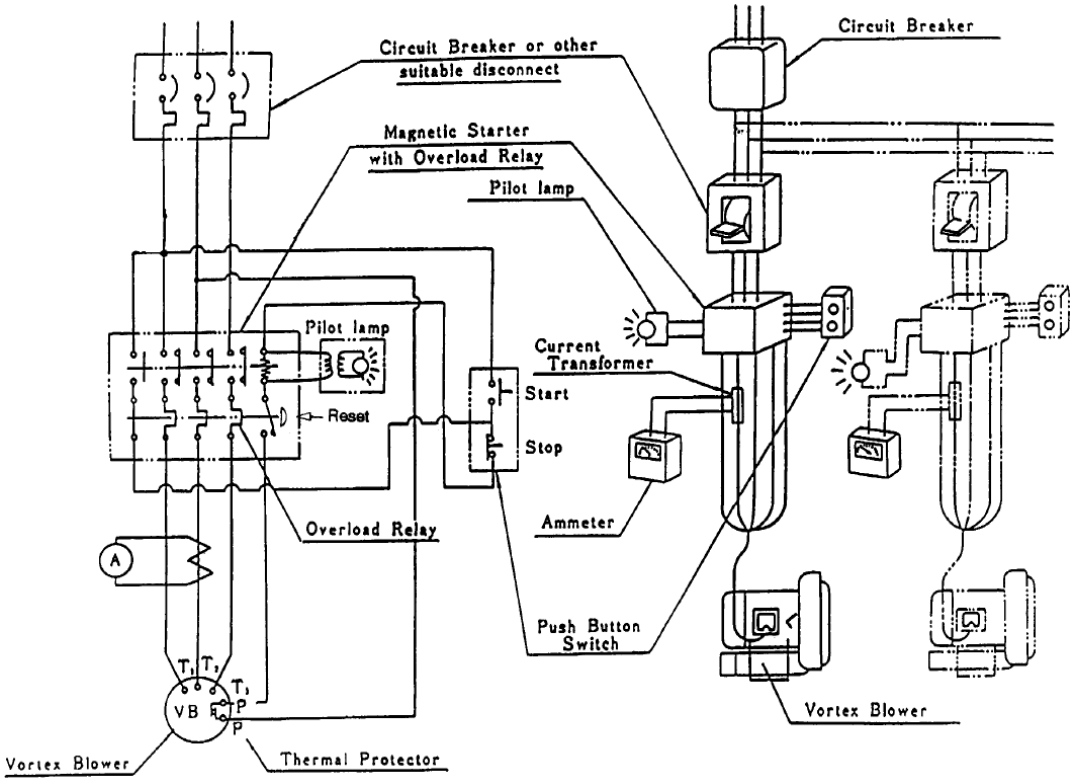


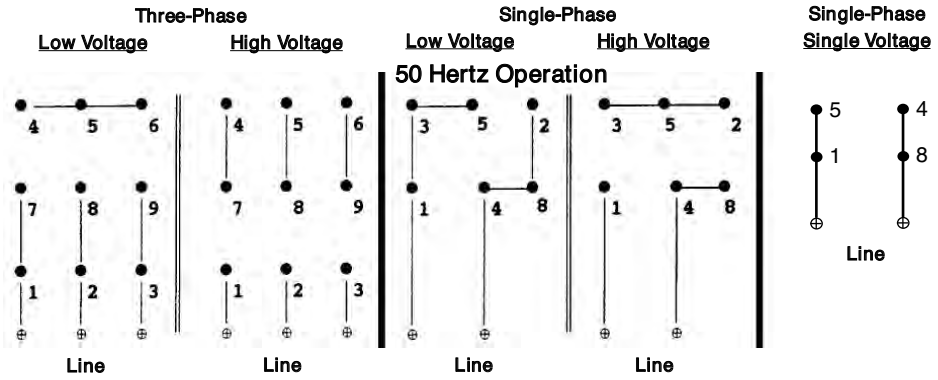
Fig. 3 Typical Wiring Diagram

Table 1 Three-Phase Motor Data - Typical Values

60 Hertz Operation						
Model No.	**VB001**	**VB002**	**VB003**	**VB004**	**VB007**	**VB019**
Power (hp)	0.13	0.25	0.5	0.75	1.5	2.5
Voltage (V)	200-230/460	200-230/460	208-230/460	200-230/460	200-230/460	200-230/460
FL Amp (A)	.5-.48/.24	.86-.73/.37	1.8-1.6/.8	2.3-2.4/1.2	4.3-4/2	7.2-6.6/3.3
Voltage (V)		575	575	575	575	575
FL Amp (A)		.4	0.8	0.96	1.4	2.1
Model No.	**VB030**	**VB037**	**VB055**	**VB075**	**VB110**	—
Power (hp)	4	5	7.5	10	15	—
Voltage (V)	200-230/460	200-230/460	200-230/460	200-230/460	200-230/460	—
FL Amp (A)	10.6-10.2/5.1	13.2-12/6	19.8-17.2/8.6	27.5-27.2/13.6	39-37/18.5	—
Voltage (V)	575	575	575	575	575	—
FL Amp (A)	3	4.8	7	9.6	13.5	—
50 Hertz Operation						
Model No.	**VB001**	**VB002**	**VB003**	**VB004**	**VB007**	**VB019**
Power (hp)	0.13	0.21	0.5	0.63	1.25	2.1
Voltage (V)	190-220/380-415	190-220/380-415	190/380-415	190/380-415	190/380-415	190/380-415
FL Amp (A)	.5-.52/.25-.26	.74-.66/.37-.34	2/1-.9	2.4/1.2-1.3	4/2	6.6/3.3-3.1
Model No.	**VB030**	**VB037**	**VB055**	**VB075**	**VB110**	—
Power (hp)	3.4	4.2	6.25	8.33	12.5	—
Voltage (V)	190/380-415	190/380-415	190/380-415	190/380-415	190/380-415	—
FL Amp (A)	10.2/5.2-5.1	11.8/5.9-5.6	17.6/8.8-8.2	27/13.5-14.5	36/18-17	—

NOTE: Thermostats are provided on the VB004 and larger models.

MOTOR WIRING



NOTES: (1) For three-phase, interchange any two line connections to reverse shaft rotation
(2) For single-phase, interchange motor leads 5 and 8 to reverse shaft rotation

THERMOSTATS VB004 AND LARGER

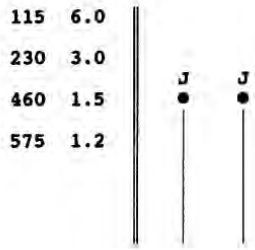


Table 2 Single-Phase Motor Data - Typical Values

60 Hertz Operation								
Model No.	**VB001S**	**VB002S**	**VB003S**	**VB004S**	**VB007S**	**VB019S**	**VB030S**	**VB037S**
Power (hp)	0.13	0.25	0.5	0.75	1.5	2.5	4	5
Voltage (V)	115/230	115/230	115/230	115/208-230	115/208-230	115/208-230	115/208-230	230
FL Amps (A)	1.25/.63	2.3/1.15	5.2/2.6	9.6/5-4.8	13.4/6.7	22/11.5-11	34.8/18.5-17.4	20.8
50 Hertz Operation								
Model No.	**VB001S**	**VB002S**	**VB003S**	**VB004S**	**VB007S**	**VB019S**	**VB030S**	**VB037S**
Power (hp)	0.13	0.21	0.5	0.63	1.25	2.1	3.3	4.2
Voltage (V)	110/220	110/220	110/220	100-110/220	110/220	100-110/220	100-110/220	220
FL Amps (A)	1.34/.67	2.1/1.05	5.6/2.8	9.9-11.6/5.8	15.4/7.7	22-21/10.5	42-38.6/19.3	19

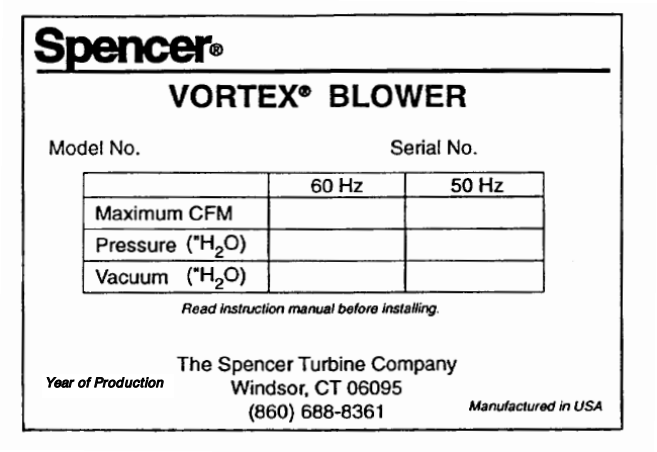


Fig. 4 Typical Nameplate

III. Operation

Limits of Operation

Operation at flows less than those indicated by the solid line on the applicable performance curve will cause overheating of the unit and is to be avoided. **Throttling suction or discharge piping to reduce air volume increases differential pressure resulting in elevated temperature and increased power consumption. Use of pressure and/ or vacuum relief valve recommended.**

Maximum pressure and vacuum are indicated on the nameplate (see Fig. 4). These represent conditions at which the minimum allowable airflow (CFM) occurs. Check the operating pressure or vacuum to assure that the pressure or vacuum remains less than maximum.

For continuous operation at low air volume (on the dotted portion of the performance curve), provide a bypass in the piping and operate at a lower pressure than maximum operating pressure. See Performance Curves, Section V.

Caution: Low flow conditions may produce heat levels which may cause burns. Do not touch the blower in operation.

Temperature Rise

A NEMA Class F insulation system is used in the motor. Maximum allowable winding temperature is 265˚F. If a thermal protector or thermal relay activates because the temperature rise of the motor is higher than usual, investigate and correct the problem. Explosion-proof motors use a NEMA Class B insulation. Typical causes of motor overheating are given in Section VI, Troubleshooting Guide.

IV. Disassembly and Reassembly

A. General

1. Precautions should be taken when disassembling or reassembling the blower. See Warranty Terms.
2. Keep all parts clean.
3. Do not overtighten bolts and screws.

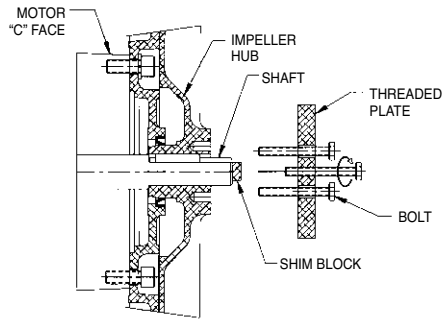


Fig. 5 Impeller Puller

B. Disassembly Procedure (Reassembly is performed in reverse order)

Caution: Shims are used to adjust the gap between the impeller and casing. When disassembling, take care to note the quantity of shims and their thickness. The shim stack replacement must be the correct thickness to assure proper clearance and to avoid degradation of performance.

1. Remove impeller cover; remove screws, pull cover away from case.
2. Unfasten lock washer; remove nut and washer.
3. Remove impeller from shaft by one of the following methods:
   a. manually pull the impeller outward, OR
   b. screw two bolts into tapped holes and pull on the bolts, OR (if the fit is tight)
   c. use a puller assembly (not furnished) as shown in Fig. 5.
4. Remove motor shaft key.
5. Remove case from motor; if necessary remove screws holding case to base and motor to case.
6. Remove shims from motor shaft if necessary; do not discard them. See Note above.

Caution: Motors are heavy. Lift motor on models larger than VB002 by the eyebolt on the motor with an aid from a lifting device.

C. Reassembly Guidance

1. The gap between the impeller and case is essential for proper performance of the unit. The shims between the shaft collar and impeller hub establish the spacing of this gap. In reassembly, before installing the impeller cover, check the gap between the impeller and case to assure that the measurement conforms to the gap specification on the assembly drawing (on the following pages) for your unit.

2. For models VB001, VB002 and VB003, gap clearance between impeller and unibody case should be checked around entire periphery of the impeller in accordance with Item 18, impeller to case gap specification prior to securing impeller.

3 On models VB004 thru VB110 remove Item 23 Plug located on bottom of the case and check impeller gap with a feeler gauge. Remove impeller and adjust shims to meet gap specification. With adjustments and gap check complete, replace plug tightly to prevent air leakage.

4. Fasten impellers using lockwashers and locknuts. Torgue locknut to recommended torque values in Table 3. Bend a lockwasher tab down into a lockwasher slot.

5. Reattach the impeller cover.

Catalog No.	Recommended Torque (Ft-Lb)
VB001, VB001S, VB002 VB002S, VB003, VB003S	22
VB004, VB004S	31
VB007, VB007S	36
VB019, VB019S	36
VB030, VB030S	44
VB037, VB037S	44
VB055	77
VB075	90
VB110	90

Table 3 Locknut Torque

V. Vortex Blower Data

Pages 7 through 17 present information about the various blower models. This information is important in understanding your blower's performance, in using the blower in the proper operating range, and in ordering parts that might be needed.

A. Assembly Diagrams

At the top of each page is an assembly diagram of the unit. Items are identified by circled numbers around the diagram. Above each diagram is the gap specification.

B. Parts Lists

At the lower left of each diagram is a table giving the item number (shown on the Assembly Diagram), the Part No. for that item and the corresponding part description. In ordering parts, provide the model number, the part number and the description.

C. Performance Curves

At the lower right of each diagram are performance curves for 50Hz and 60Hz operation. The curves present the following information:

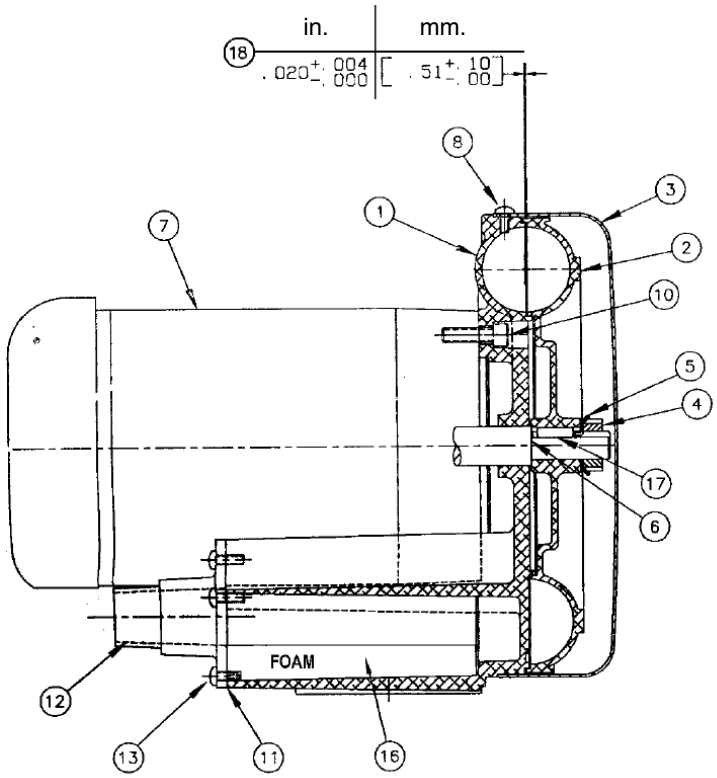
The upper line of each curve is pressure performance while the lower line is vacuum performance. The dashed portion at the left end of some of the curves indicates an intermittent-only operating area. See **Operation** Section on page 5.

D. Estimated Acoustical Noise Level at 1.5M, 60Hz

Model	dba
VB001S	62
VB001	61
VB002S	61
VB002	61
VB003S	66
VB003	66
VB004S	63
VB004	63
VB007S	70
VB007	64
VB019S	70
VB019	73
VB030S	71
VB030	73
VB037S	74
VB037	76
VB055	82
VB075	81
VB110	80

Spencer® Vortex® Regenerative Blowers
VB001S, VB001

Assembly Diagram

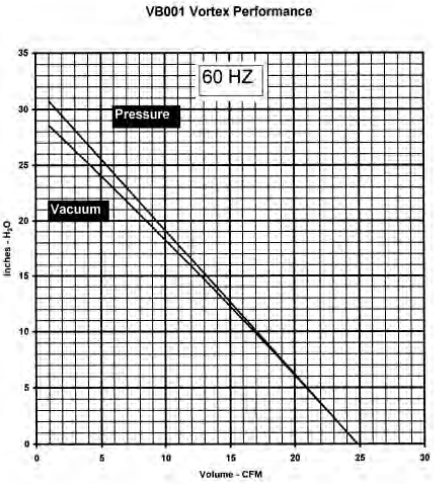


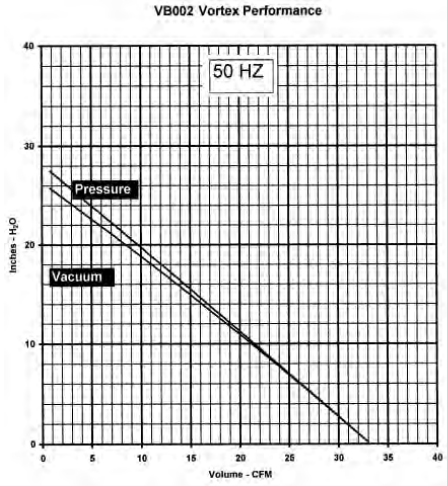
Parts List

DESCRIPTION: VORTEX BLOWER ASSEMBLY – VB001S & VB001			
ITEM	PART NO.	DESCRIPTION	QTY.
1	VBC90101	Case, Unibody	1
2	VBI90101	Impeller	1
3	VBE90101	Cover, Impeller	1
4	NUT90219	Locknut, Shaft	1
5	WSH90184	Lockwasher, Shaft	1
6	WSH90185	Shim, Shaft to Impeller (as required)	1
7	MOT90210	Motor 42C, 1/8 HP, 1PH, 50/60Hz	1
7A	MOT90215	Motor 42C, 1/8 HP, 3PH, 50/60Hz	1
8	SCR90901	M4 x 0.7 Pan Head Phillips Screw x .31 [8] Long	4
10	SCR90307	1/4-20 x .625" Long Socket Cap Screw	4
11	GSK90168	Gasket, Flange	1
12	FLC90013	Flange	1
13	SCR90888	M5 x 0.8 Hex Head Bolt x .63 [16] long	6
16	INS90014	Absorber	2
17	KEY90083	Key	1
18	N/A	Impeller to case gap specification	N/A

VB001S, VB001

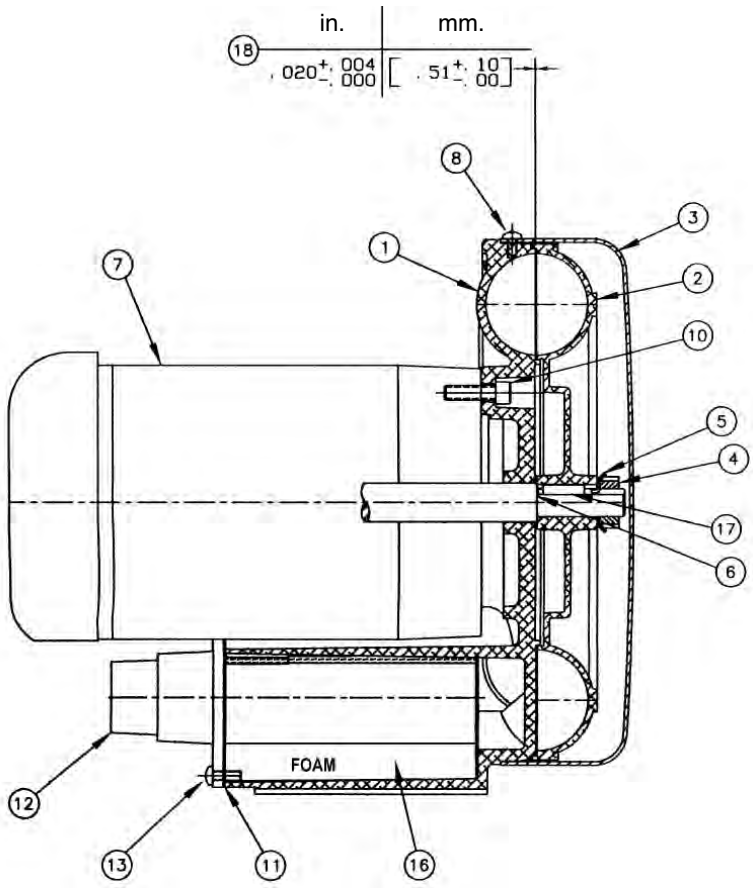
Performance Curves





Spencer® Vortex® Regenerative Blowers
VB002S, VB002

Assembly Diagram

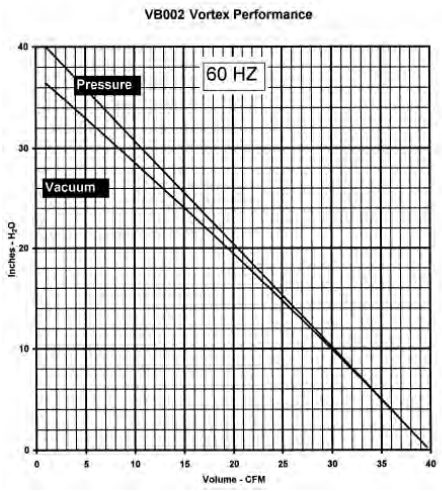


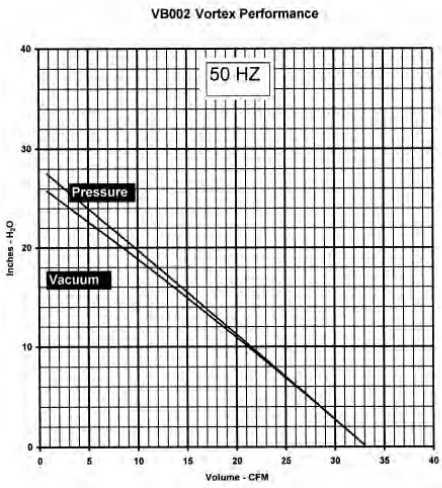
Parts List

DESCRIPTION: VORTEX BLOWER ASSEMBLY – VB002S & VB002			
ITEM	PART NO.	DESCRIPTION	QTY.
1	VBC90201	Case, Unibody	1
2	VBI90201	Impeller	1
3	VBE90201	Cover, Impeller	1
4	NUT90219	Locknut, Shaft	1
5	WSH90184	Lockwasher, Shaft	1
6	WSH90185	Shim, Shaft to Impeller (as required)	1
7	MOT90211	Motor 42C, 1/4 HP, 1PH, 50/60Hz	1
7A	MOT90212	Motor 42C, 1/4 HP, 3PH, 50/60Hz	1
8	SCR90901	M4 x 0.7 Pan Head Phillips Screw x .31 [8] Long	4
10	SCR90307	1/4-20 x .625" Long Socket Cap Screws	4
11	GSK90169	Gasket, Flange	1
12	FLC90014	Flange	1
13	SCR90888	M5 x 0.8 Hex Head Bolt x .63 [16] Long	6
16	INS90015	Absorber	2
17	KEY90085	Key	1
18	N/A	Impeller to case gap specification	N/A

VB002S, VB002

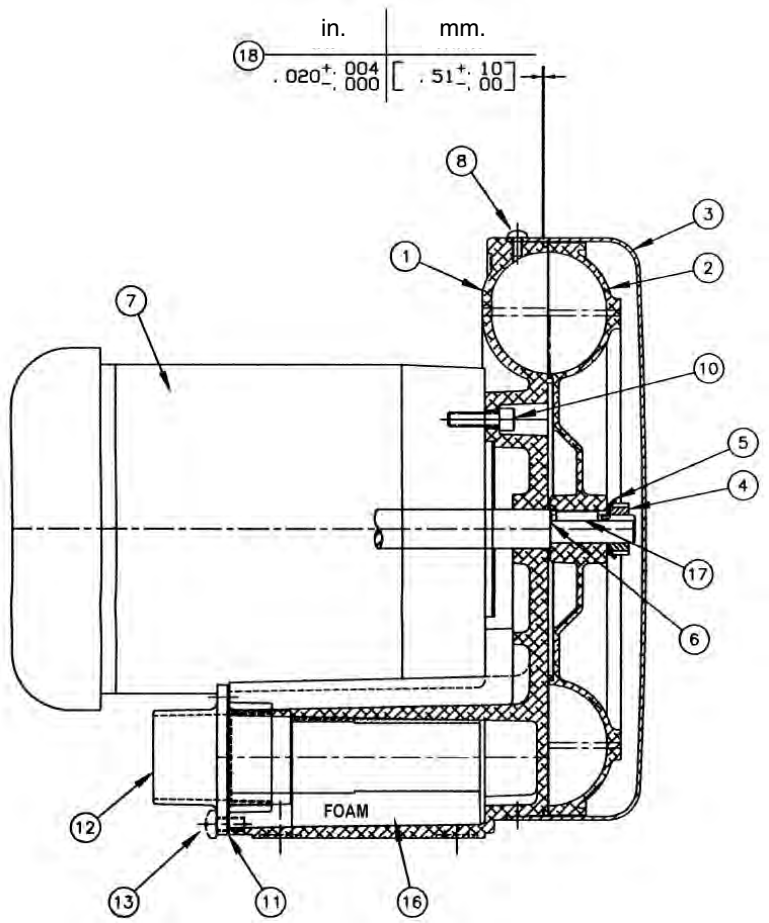
Performance Curves





Spencer® Vortex® Regenerative Blowers
VB003S, VB003

Assembly Diagram

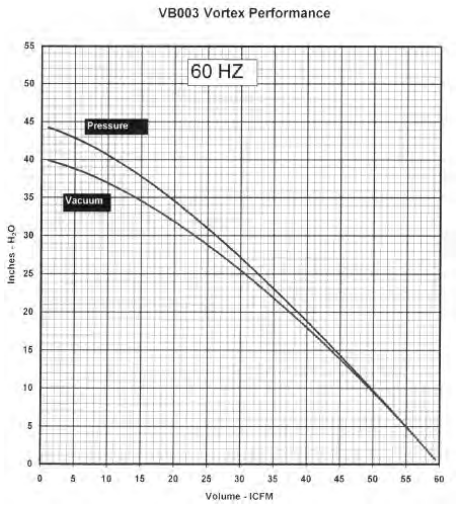


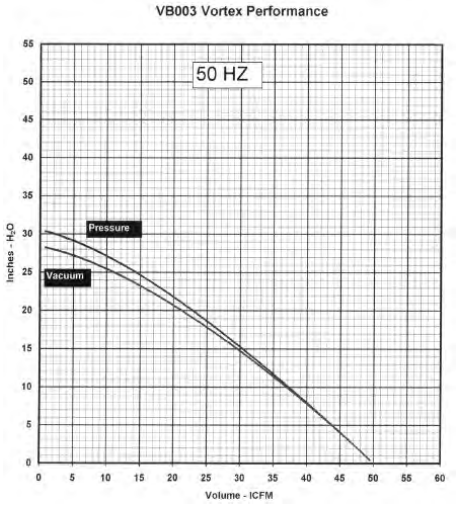
Parts List

DESCRIPTION: VORTEX BLOWER ASSEMBLY – VB003S & VB003			
ITEM	PART NO.	DESCRIPTION	QTY.
1	VBC90301	Case, Unibody	1
2	VBI90301	Impeller	1
3	VBE90301	Cover, Impeller	1
4	NUT90219	Locknut, Shaft	1
5	WSH90184	Lockwasher, Shaft	1
6	WSH90185	Shim, Shaft to Impeller (as required)	1
7	MOT90213	Motor 48C, 1/2 HP, 1PH, 50/60Hz	1
7A	MOT90214	Motor 48C, 1/2 HP, 3PH, 50/60Hz	1
7B	MOT90229	Motor 48C, 1/2 HP, 3PH, 575 Volt, 50/60Hz	1
7C	MOT90470	Motor 48C, 1/2 HP, 3PH, 60Hz	1
7D	MOT90469	Motor 48C, 1/2 HP, 1PH, 60Hz	1
8	SCR90901	M4 x 0.7 Pan Head Phillips Screw x .31 [8] Long	4
10	SCR90307	1/4-20 x .625" Long Socket Cap Screw	4
11	GSK90170	Gasket, Flange	1
12	FLC90015	Flange	1
13	SCR90888	M5 x 0.8 Hex Head Bolt x .63 [16] Long	6
16	INS90016	Absorber	2
17	KEY90085	Key	1
18	N/A	Impeller to case gap specification	N/A

VB003S, VB003

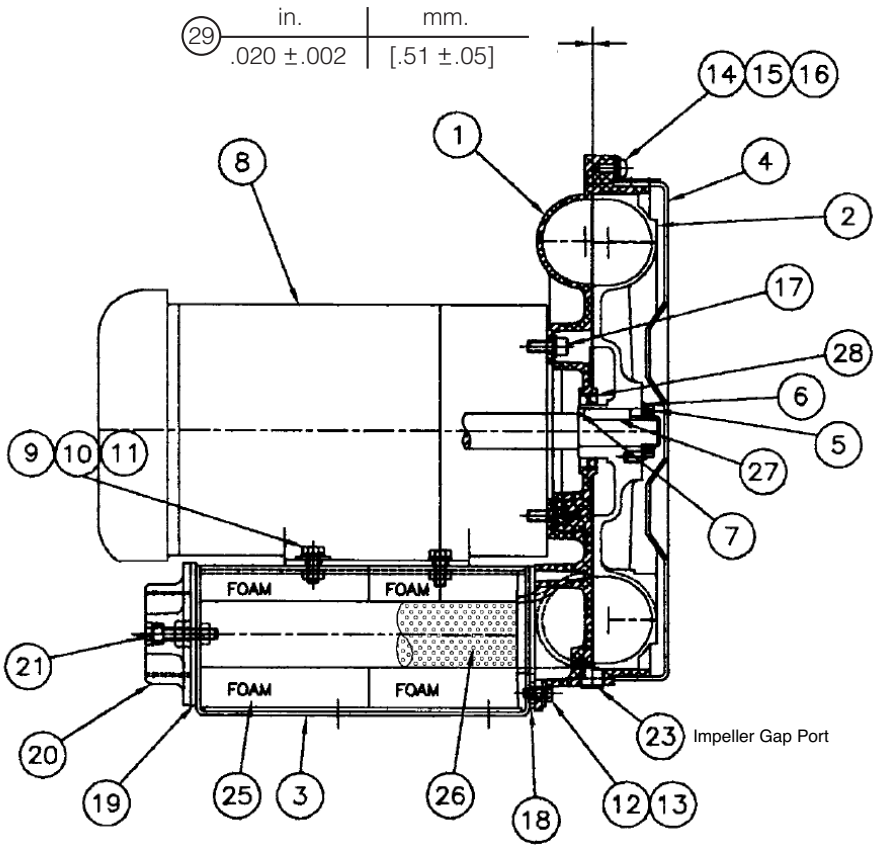
Performance Curves





Spencer® Vortex® Regenerative Blowers
VB004S, VB004

Assembly Diagram

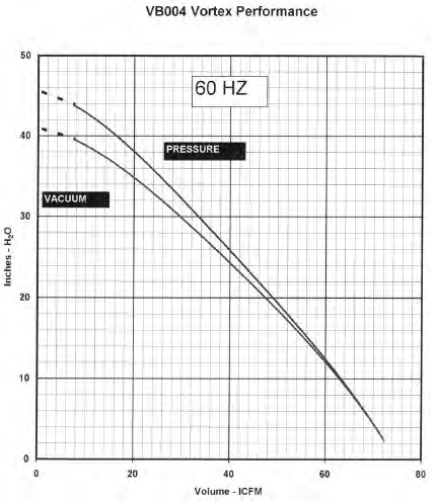


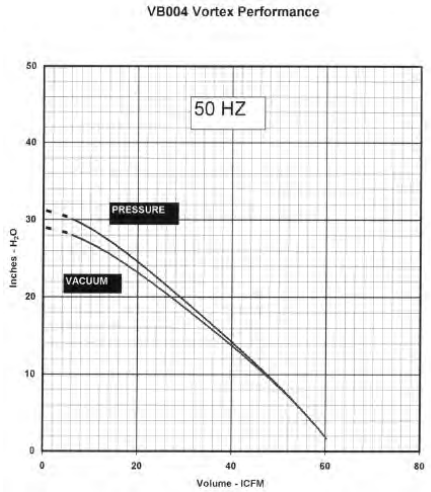
Parts List

DESCRIPTION: VORTEX BLOWER ASSEMBLY – VB004S & VB004			
ITEM	PART NO.	DESCRIPTION	QTY.
1	VBC90401	Case	1
2	VBI90401	Impeller	1
3	VBB90401	Base	1
4	VBE90401	Cover, Impeller	1
5	NUT90212	Locknut, Shaft	1
6	WSH90170	Lockwasher, Shaft	1
7	WSH90177	Shim, Shaft to Impeller (as required)	1
8	MOT90193	Motor 48C, 3/4 HP, 1PH, 50/60Hz	1
8A	MOT90192	Motor 48C, 3/4 HP, 3PH, 50/60Hz	1
8B	MOT90230	Motor 48C, 3/4 HP, 3PH, 575 Volt, 50/60Hz	1
8C	MOT90471	Motor 48C, 3/4 HP, 3PH, 60Hz	1
8D	MOT90472	Motor 48C, 3/4 HP, 1PH, 60Hz	1
9	SCR90887	M6 x 1.0 Hex Head Bolt x .63 [16] Long	4
10	WSH90142	Lock washer, M5	4
11	WSH90166	Flat Washer, M5	4
12	SCR90888	M5 x 0.8 Hex Head Bolt x .63 [16] Long	2
13	WSH90181	Flat Washer, M5	2
14	SCR90877	M5 x 0.8 Pan Head Phillips Screw x .39 [10] Long	4
15	WSH90138	Lockwasher, M5	4
16	WSH90139	Flat Washer, M5	4
17	SCR90307	1/4-20 x .625" Long Socket Cap screw	4
18	GSK90165	Gasket, Case	1
19	GSK90163	Gasket, Flange	2
20	FLC90007	Flange	2
21	SCR90931	M6 x 1.0 S.H.C.S. x .98 [25] Long	4
23	PLG90037	Plug, 1/4 NPT x .43 [11] Long	1
25	INS90017	Absorber	4
26	SCN90065	Screen	2
27	KEY90076	Key	1
28	SEL90108	Lip Seal	1
29	N/A	Impeller to case gap specification	N/A

VB004S, VB004

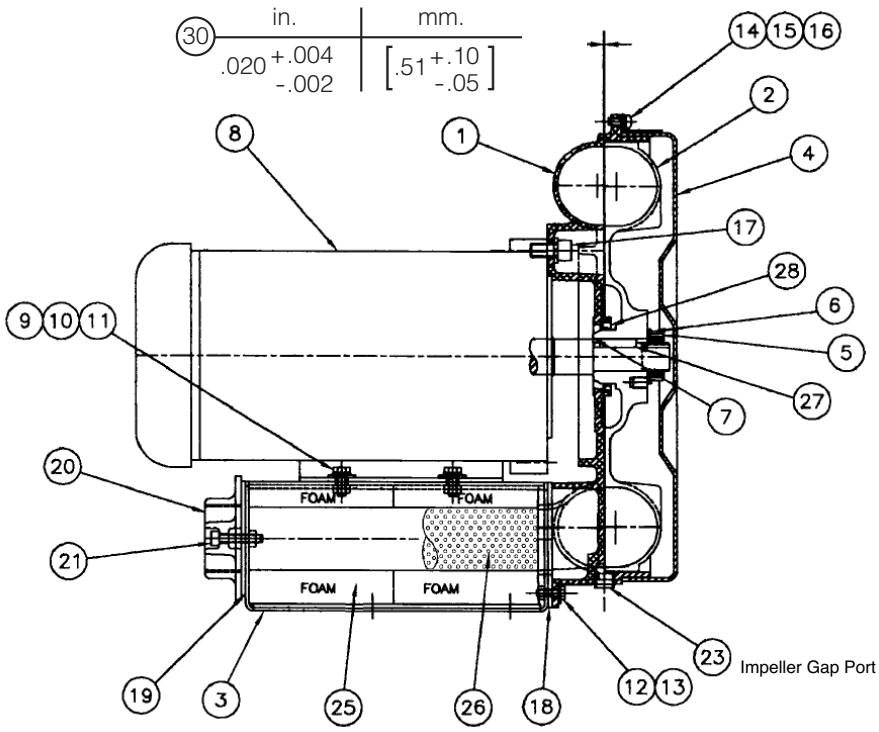
Performance Curves





Spencer® Vortex® Regenerative Blowers
VB007S, VB007, VB007SXP, VB007XP

Assembly Diagram



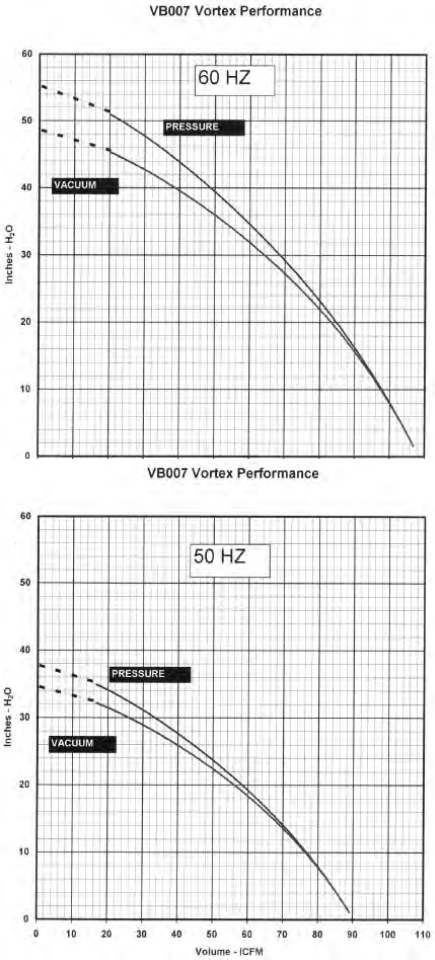
(See Bulletin 417, pages 34 and 35 for specifics on models with explosion-proof motors.)

Parts List

DESCRIPTION: VORTEX BLOWER ASSEMBLY – VB007S, VB007, VB007SXP, VB007XP			
ITEM	PART NO.	DESCRIPTION	QTY.
1	VBC90701	Case	1
2	VBI90701	Impeller	1
3	VBB90701	Base	1
4	VBE90701	Cover, Impeller	1
5	NUT90210	Locknut, Shaft	1
6	WSH90171	Lockwasher, Shaft	1
7	WSH90160	Shim, Shaft to Impeller (as required)	1
8C	MOT90225	Motor, 56C, 1-1/2 HP, 3PH, XP, 50/60Hz	1
8D	MOT90358	Motor, 56C, 1-1/2 HP, 1PH, XP, 50/60Hz	1
8G	MOT90248	Motor, 56C, 1-1/2 HP, 3PH, 50/60Hz	1
8H	MOT90253	Motor, 56C, 1-1/2 HP, 1PH, 50/60Hz	1
8I	MOT90485	Motor, 56C, 1-1/2 HP, 3PH, 60Hz	1
8J	MOT90484	Motor, 56C, 1-1/2 HP, 1PH, 60Hz	1
9	SCR90887	M6 x 1.0 Hex Head Bolt x .63 [16] Long	4
10	WSH90142	Lockwasher, M6	4
11	WSH90166	Flat Washer, M6	4
12	SCR90888	M5 x 0.8 Hex Head Bolt x .63 [16] Long	2
13	WSH90181	Washer, Flat M5	2
14	SCR90877	M5 x 0.8 Pan Head Phillips Screw x .39 [10] Long	4
15	WSH90138	Lockwasher, M5	4
16	WSH90139	Flat Washer, M5	4
17	SCR90867	3/8-16 x .75" Long Socket Cap Screw	4
18	GSK90164	Gasket, Case	1
19	GSK90163	Gasket, Flange	2
20	FLC90008	Flange, 1 1/2 FNPT	2
21	SCR90931	M6 x 1.0 S.H.C.S. x .98 [25] Long	4
23	PLG90037	Plug, 1/4 NPT x .43 [11] Long	1
25	INS90018	Absorber	4
26	SCN90064	Screen	2
27	KEY90076	Key	1
28	SEL90107	Lip Seal	1
30	N/A	Impeller to case gap specification	N/A

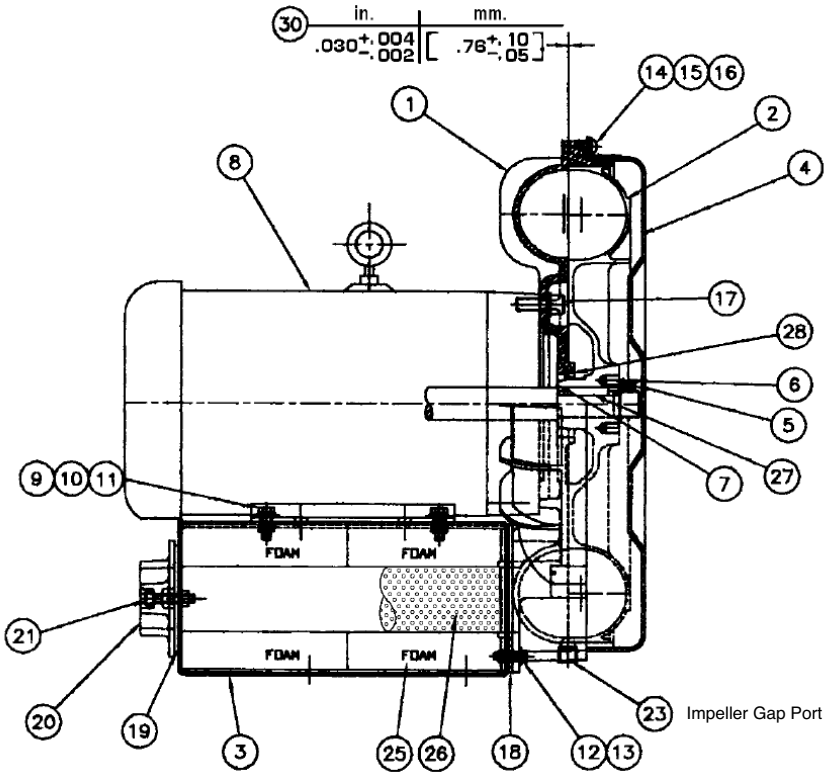
VB007S, VB007

Performance Curves



Spencer® Vortex® Regenerative Blowers
VB019S, VB019, VB019SXP, VB019XP

Assembly Diagram



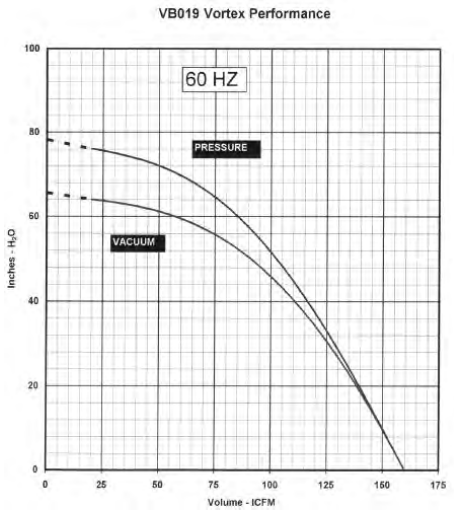
(See Bulletin 417, pages 36 and 37 for specifics on models with explosion-proof motors.)

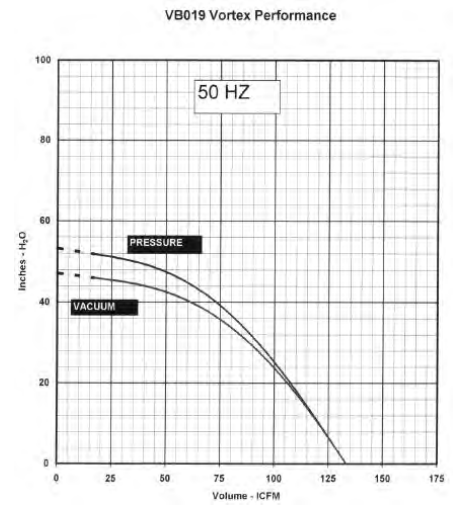
Parts List

DESCRIPTION: VORTEX BLOWER ASSEMBLY – VB019S, VB019, VB019SXP, VB019XP			
ITEM	PART NO.	DESPCRIPTION	QTY.
1	VBC91901	Case	1
2	VBI91901	Impeller	1
3	VBB91901	Base	1
4	VBE91901	Cover, Impeller	1
5	NUT90210	Locknut, Shaft	1
6	WSH90171	Lockwasher, Shaft	1
7	WSH90160	Shim, Shaft to Impeller (as required)	1
8	MOT90254	Motor, 145TC, 2-1/2 HP, 1PH, 50/60Hz	1
8A	MOT90249	Motor, 145TC, 2-1/2 HP, 3PH, 50/60Hz	1
8B	MOT90347	Motor, 145TC, 2-1/2 HP, 3PH, 575 Volt, 50/60Hz	1
8C	MOT90224	Motor, 145TC, 2-1/2 HP, 3PH, XP, 50/60Hz	1
8D	MOT90359	Motor, 145TC, 2-1/2 HP, 1PH, XP, 50/60Hz	1
8E	MOT90476	Motor, 145TC, 2-1/2 HP, 3PH, 60Hz	1
8F	MOT90475	Motor, 145TC, 2-1/2 HP, 1PH, 60Hz	1
9	SCR90887	M6 x 1.0 Hex Head Bolt x .63 [16] Long	4
9ALT	SCR90876	M6. x 1.0 Hex Head Bolt x .98 [25] Long (Cast Motor)	4
10	WSH90142	Lockwasher, M6	4
11	WSH90166	Flat Washer, M6	4
12	SCR90943	M5 x 0.8 Hex Head Bolt x .79 [20] Long	2
13	WSH90181	Flat Washer, M5	2
14	SCR90877	M5 x 0.8 Pan Head Phillips Screw x .39 [10] Long	4
15	WSH90138	Lockwasher, M5	4
16	WSH90139	Flat Washer, M5	4
17	SCR90867	3/8-16 x .75" Long Socket Cap Screw	4
18	GSK90162	Gasket, Case	1
19	GSK90163	Gasket, Flange	2
20	FLC90008	Flange, 1 1/2 FNPT	2
21	SCR90931	M6 x 1.0 S.H.C.S. x .98 [25] Long	4
23	PLG90037	Plug, 1/4 NPT x .43 [11] Long	1
25	INS90019	Absorber	4
26	SCN90063	Screen	2
27	KEY90077	Key	1
28	SEL90107	Lip Seal	1
30	N/A	Impeller to case gap specification	N/A

VB019S, VB019

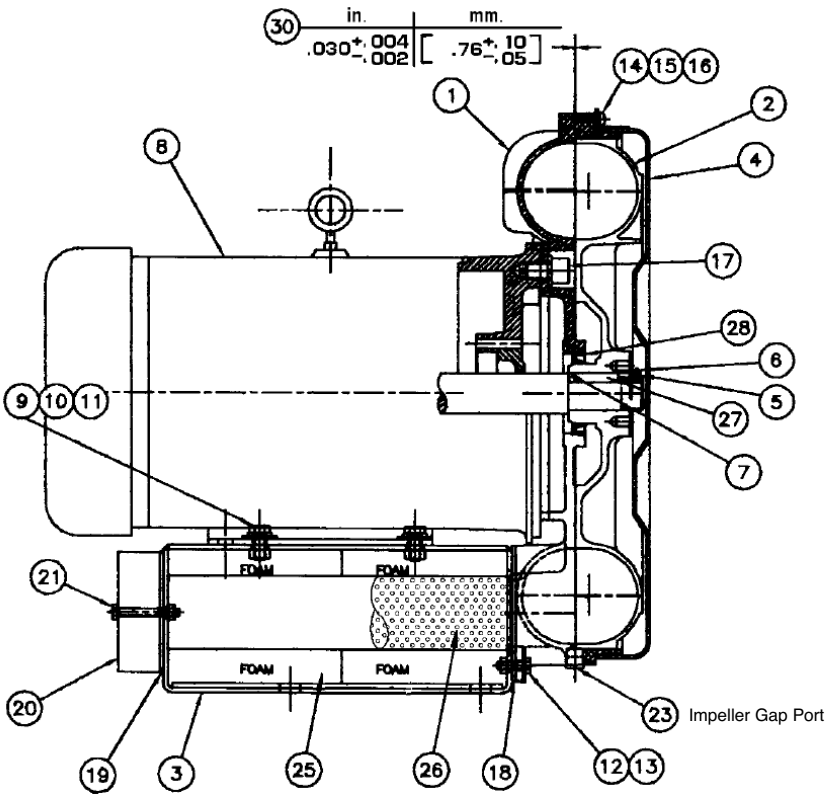
Performance Curves





Spencer® Vortex® Regenerative Blowers
VB030S, VB030, VB030XP

Assembly Diagram



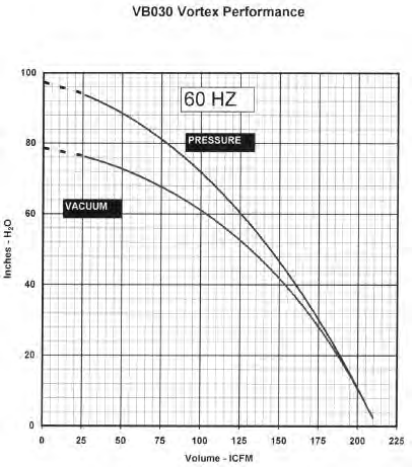
(See Bulletin 417, pages 38 and 39 for specifics on models with explosion-proof motors.)

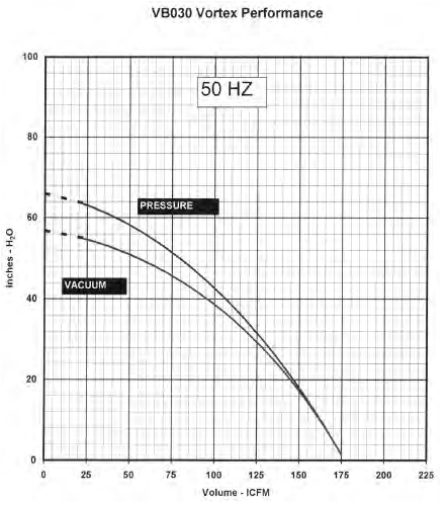
Parts List

DESCRIPTION: VORTEX BLOWER ASSEMBLY – VB030S, VB030, VB030XP			
ITEM	PART NO.	DESCRIPTION	QTY.
1	VBC93001	Case	1
2	VBI93001	Impeller	1
3	VBB93001	Base	1
4	VBE93001	Cover, Impeller	1
5	NUT90209	Locknut, Shaft	1
6	WSH90172	Lockwasher, Shaft	1
7	WSH90157	Shim, Shaft to Impeller (as required)	1
8	MOT90370	Motor, 184TC, 4 HP, 1PH, 50/60Hz	1
8A	MOT90250	Motor, 182TC, 4 HP, 3PH, 50/60Hz	1
8B	MOT90348	Motor, 182TC, 4 HP, 3PH, 575 Volt, 50/60Hz	1
8C	MOT90223	Motor, 182TC, 4 HP, 3PH, XP, 50/60Hz	1
8D	MOT90478	Motor, 182TC, 4 HP, 3PH, 60Hz	1
8E	MOT90477	Motor, 182TC, 4 HP, 1PH, 60Hz	1
9	SCR90879	M8 x 1.25 Hex Head Bolt x .98 [25] Long	4
10	WSH90148	Lockwasher, M8	4
11	WSH90182	Flat Washer, M8	4
12	SCR90876	M6 x 1.0 Hex Head Bolt x .98 [25] Long	2
13	WSH90166	Flat Washer, M6	2
14	SCR90877	M5 x 0.8 Pan Head Phillips Screw x .39 [10] Long	4
15	WSH90138	Lockwasher, M5	4
16	WSH90139	Flat Washer, M5	4
17	SCR90335	1/2 -13 x 1.0 Long Socket Cap Screw	4
18	GSK90161	Gasket, Case	1
19	GSK90155	Gasket, Flange	2
20	FLC90009	Flange, 2 FNPT	2
21	SCR90878	M6 x 1.0 Hex Head Bolt x 1.57 [40] Long	4
23	PLG90037	Plug, 1/4 NPT x .43 [11] Long	1
25	INS90020	Absorber	4
26	SCN90062	Screen	2
27	KEY90078	Key	1
28	SEL90104	Lip Seal	1
30	N/A	Impeller to case gap specification	N/A

VB030S, VB030

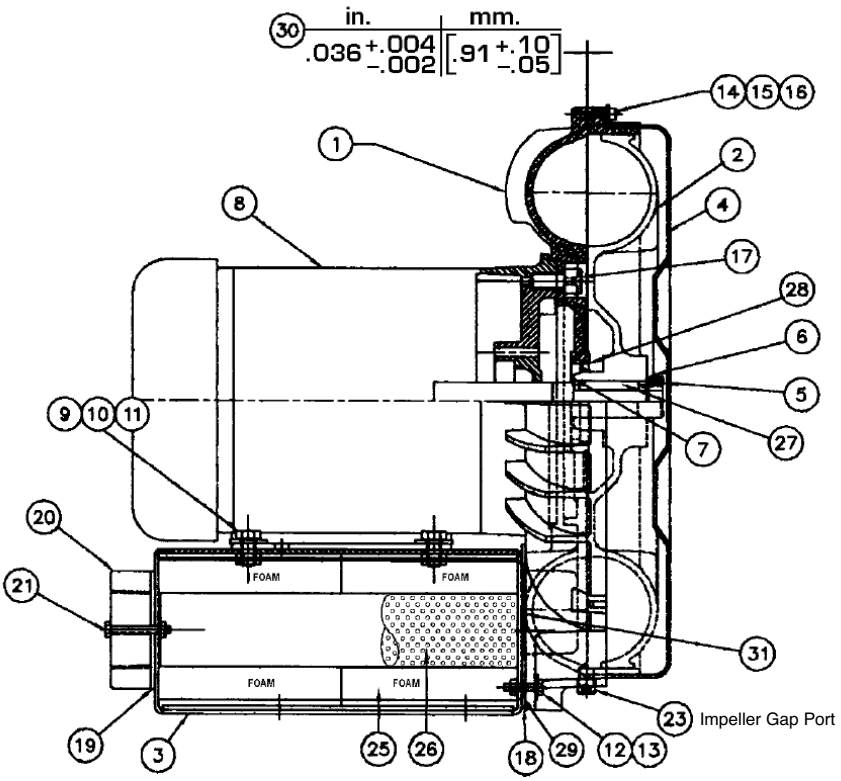
Performance Curves





Spencer® Vortex® Regenerative Blowers
VB037S, VB037, VB037XP

Assembly Diagram



(See Bulletin 417, pages 40 and 41 for specifics on models with explosion-proof motors.)

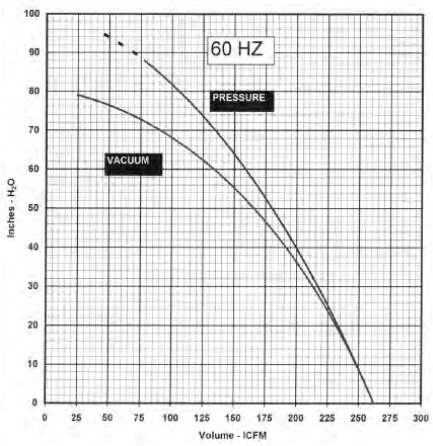
Parts List

DESCRIPTION: VORTEX BLOWER ASSEMBLY – VB037S, VB037, VB037XP			
ITEM	PART NO.	DESCRIPTION	QTY.
1	VBC93701	Case	1
2	VBI93702	Impeller	1
3	VBB93700	Base	1
4	VBE93701	Cover, Impeller	1
5	NUT90209	Locknut, Shaft	1
6	WSH90172	Lockwasher, Shaft	1
7	WSH90157	Shim, Shaft to Impeller (as required)	1
8	MOT90361	Motor, 184TC, 5 HP, 1PH, 50/60Hz	1
8A	MOT90181	Motor, 184TC, 5 HP, 3PH, 50/60Hz	1
8B	MOT90234	Motor, 184TC, 5 HP, 3PH, 575 Volt, 50/60Hz	1
8C	MOT90222	Motor, 184TC, 5 HP, 3PH, XP, 50/60Hz	1
8D	MOT90480	Motor, 184TC, 5 HP, 3PH, 60Hz	1
8E	MOT90479	Motor, 184TC, 5 HP, 1PH, 60Hz	1
9	SCR90879	M8 x 1.25 Hex Head Bolt x .98 [25] Long	4
10	WSH90148	Lockwash, M8	4
11	WSH90182	Flat Washer, M8	4
12	SCR90878	M6 x 1.0 Hex Head Bolt x 1.57 [40] Long	2
13	WSH90166	Flat Washer, M6	2
14	SCR90877	M5 x 0.8 Pan Head Phillips Screw x .39 [10] Long	4
15	WSH90138	Lockwasher, M5	4
16	WSH90139	Flat Washer, M5	4
17	SCR90335	1/2-13 x 1.0 Long Socket Cap Screw	4
18	GSK90154	Gasket, Case	1
19	GSK90155	Gasket, Flange	2
20	FLC90009	Flange, 2 FNPT	2
21	SCR90878	M6 x 1.0 Hex Head Bolt x 1.57 [40] Long	4
23	PLG90037	Plug, 1/4 NPT x .43 [11] Long	1
25	INS90021	Absorber	4
26	SCN90056	Absorber Screen	2
27	KEY90079	Key	1
28	SEL90104	Lip Seal	1
29	SPR90088	Spacer, Washer (Case to Base)	2
30	N/A	Impeller to case gap specification	N/A
31	PLC90027	Plate, Case	1

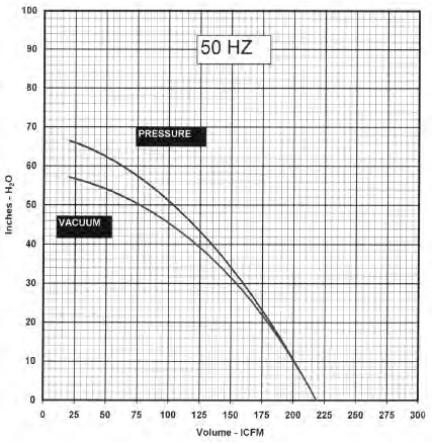
VB037S, VB037

Performance Curves

VB037 Vortex Performance

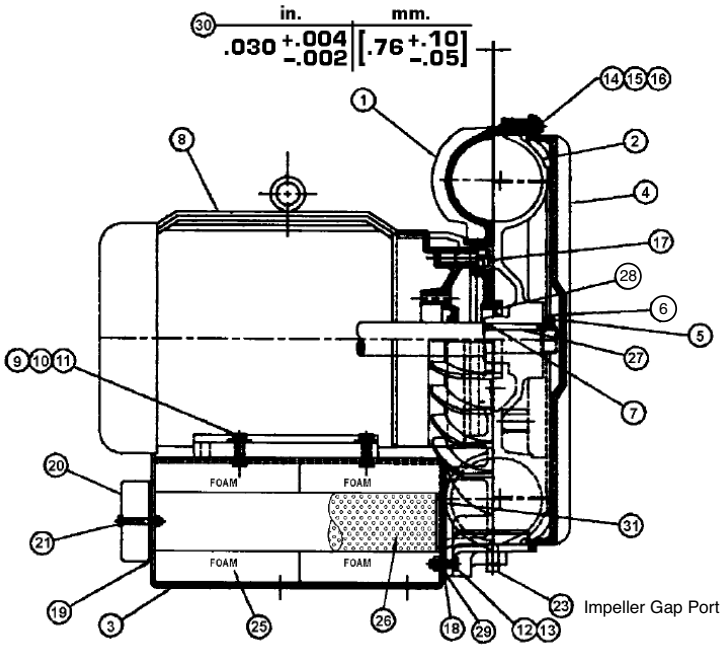


VB037 Vortex Performance



Spencer® Vortex® Regenerative Blowers
VB055, VB055XP

Assembly Diagram



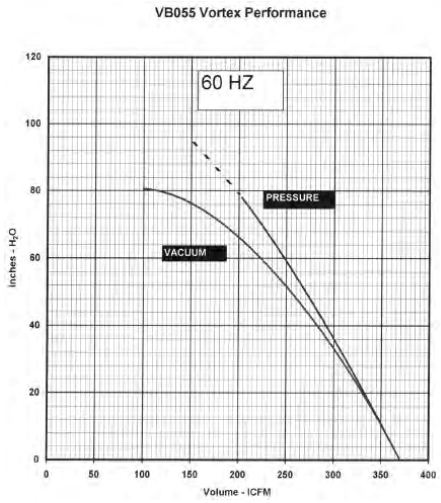
(See Bulletin 417, pages 42 and 43 for specifics on models with explosion-proof motors.)

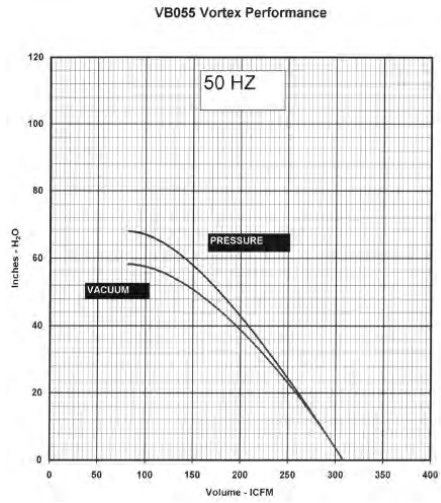
Parts List

DESCRIPTION: VORTEX BLOWER ASSEMBLY – VB055, VB055XP			
ITEM	PART NO.	DESCRIPTION	QTY.
1	VBC95501	Case	1
2	VBI95502	Impeller	1
3	VBB95501	Base	1
4	VBE95501	Cover, Impeller	1
5	NUT90211	Locknut, Shaft	1
6	WSH90173	Lockwasher, Shaft	1
7	WSH90154	Shim, Shaft to Impeller (as required)	1
8	MOT90182	Motor, 213TC, 7-1/2 HP, 3PH, 50/60Hz	1
8A	MOT90205	Motor, 213TC, 7-1/2 HP, 3PH, 575 Volt, 50/60Hz	1
8B	MOT90221	Motor, 213TC, 7-1/2 HP, 3PH, XP, 50/60Hz	1
8C	MOT90481	Motor, 213TC, 7-1/2 HP, 3PH, 60Hz	1
9	SCR90881	M8 x 1.25 Hex Head Bolt x 1.18 [30] Long	4
10	WSH90148	Lockwasher, M8	4
11	WSH90182	Flat Washer, M8	4
12	SCR90895	M8 x 1.25 Hex Head Bolt x 1.57 [40] Long	2
13	WSH90182	Flat Washer, M8	2
14	SCR90876	M6 x 1.0 Hex Head Screw x .98 [25] Long	8
15	WSH90143	Lockwasher, M6	8
16	WSH90142	Washer, Flat M6	8
17	SCR90335	1/2-13 x 1.0 Long Socket Cap Screw	4
18	GSK90156	Gasket, Case	1
19	GSK90157	Gasket, Flange	2
20	FLC90010	Flange, 2-1/2 FNPT	2
21	SCR90878	M6 x 1.0 Hex Head Bolt x 1.57 [40] Long	4
23	PLG90037	Plug, 1/4 NPT x .43 [11] Long	1
25	INS90022	Absorber	4
26	SCN90057	Absorber Screen	2
27	KEY90080	Key	1
28	SEL90105	Lip Seal	1
30	N/A	Impeller to case gap specification	N/A
31	PLC90028	Case Plate	1

VB055

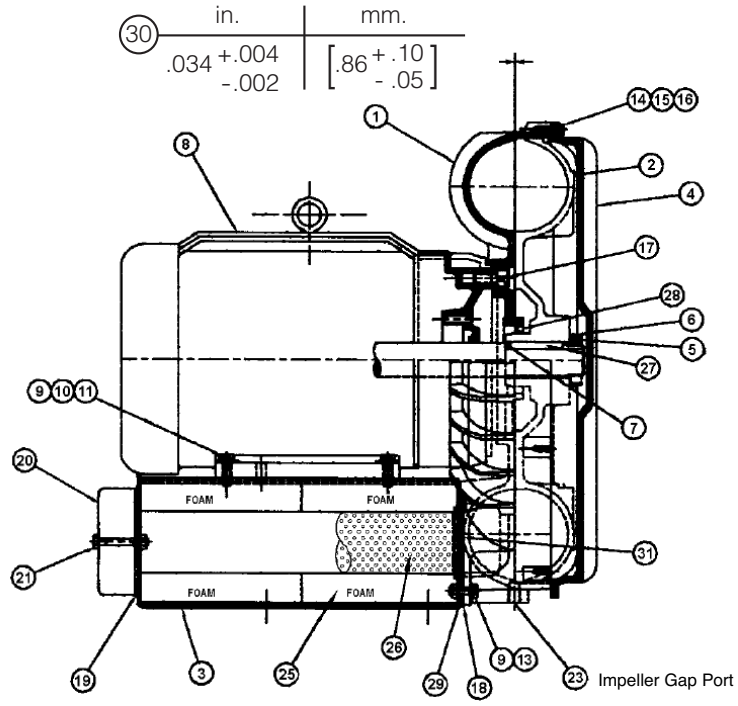
Performance Curves





Spencer® Vortex® Regenerative Blowers
VB075, VB075XP

Assembly Diagram



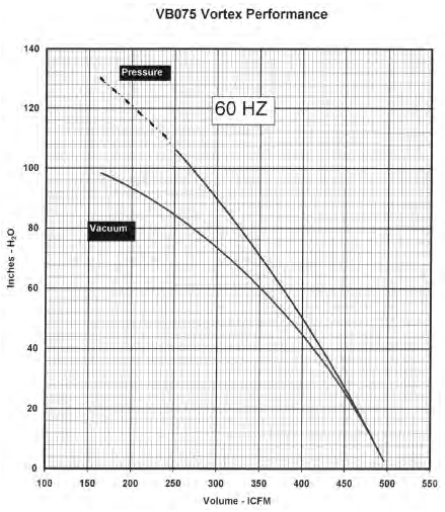
(Contact factory for specifics on models with explosion-proof motor.)

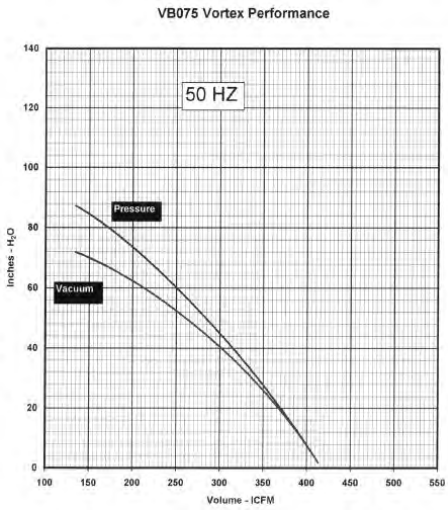
Parts List

DESCRIPTION: VORTEX BLOWER ASSEMBLY – VB075, VB075XP			
ITEM	PART NO.	DESCRIPTION	QTY.
1	VBC97501	Case	1
2	VBI97502	Impeller	1
3	VBB97501	Base	1
4	VBE97501	Cover, Impeller	1
5	NUT90213	Locknut, Shaft	1
6	WSH90174	Lockwasher, Shaft	1
7	WSH90179	Shim, Shaft to Impeller (as required)	1
8	MOT90199	Motor, 215TC, 10 HP, 3PH, 50/60Hz	1
8A	MOT90235	Motor, 215TC, 10 HP, 3PH, 575 Volt, 50/60Hz	1
8B	MOT90220	Motor, 215TC, 10 HP, 3PH, XP, 50/60Hz	1
8C	MOT90482	Motor, 215TC, 10 HP, 3PH, 60Hz	1
9	SCR90881	M8 x 1.25 Hex Head Bolt x 1.18 [30] Long	4
10	WSH90148	Lockwasher, M8	4
11	WSH90182	Flat Washer M8	4
12	SCR90881	M8 x 1.25 Hex Head Bolt x 1.18 [30] Long	2
13	WSH90182	Flat Washer M8	2
14	SCR90876	M6 x 1.0 Hex Head Screw x .98 [25] Long	8
15	WSH90143	Lockwasher, M6	8
16	WSH90142	Flat Washer M6	8
17	SCR90335	1/2-13 x 1.0 Long Socket Cap Screw	4
18	GSK90158	Gasket, Case	1
19	GSK90159	Gasket, Flange	2
20	FLC90011	Flange, 3 FNPT	2
21	SCR90883	M8 x 1.25 Hex Head Bolt x 2.165 [55] Long	4
23	PLG90037	Plug, 1/4 NPT x .43 [11] Long	1
25	INS90023	Absorber	4
26	SCN90058	Absorber Screen	2
27	KEY90081	Key	1
28	SEL90106	Lip Seal	1
29	SPR90089	Spacer, Washer (Case to Base)	2
30	N/A	Impeller to case gap specification	N/A
31	PLC90029	Case Plate	1

VB075

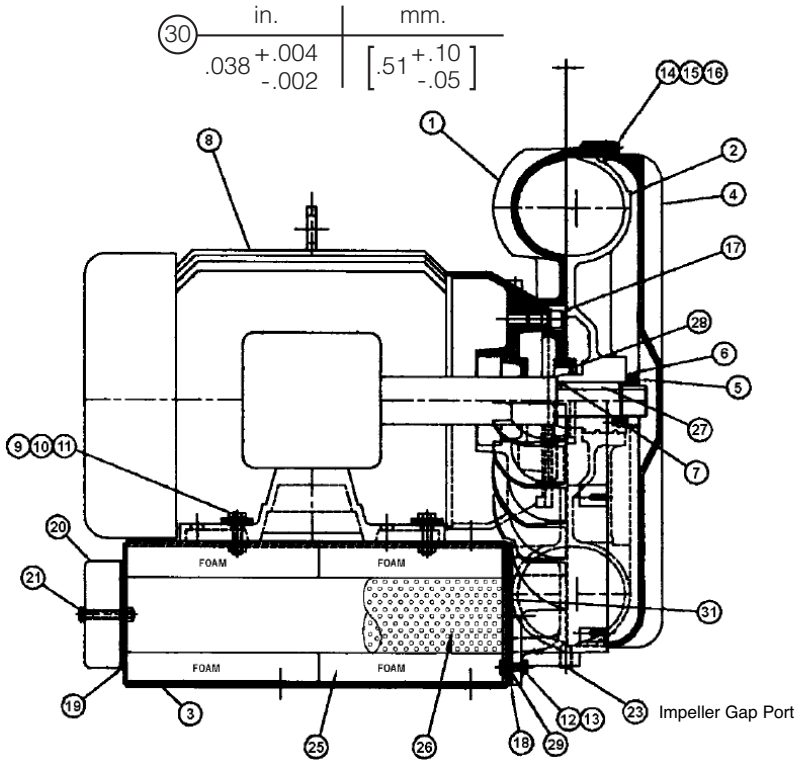
Performance Curves





Spencer® Vortex® Regenerative Blowers
VB110, VB110XP

Assembly Diagram



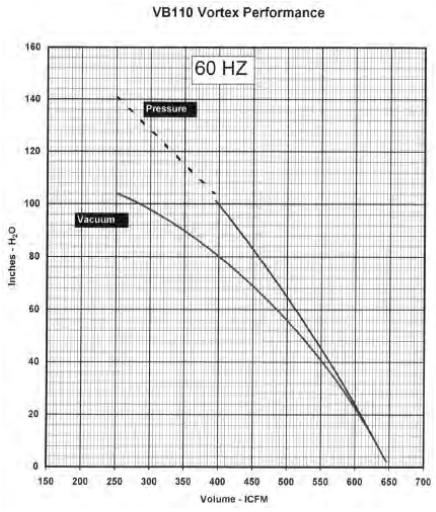
(Contact factory for specifics on models with explosion-proof motor.)

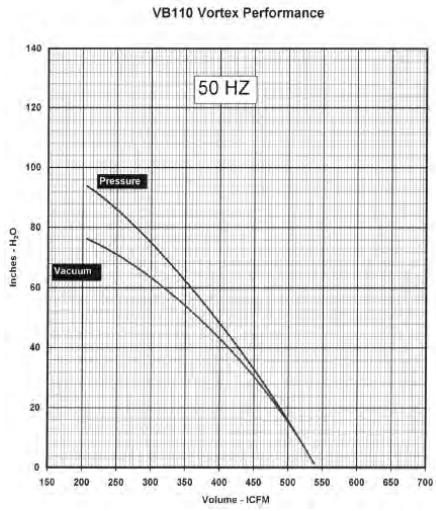
Parts List

DESCRIPTION: VORTEX BLOWER ASSEMBLY – VB110, VB110XP			
ITEM	PART NO.	DESCRIPTION	QTY.
1	VBC91101	Case	1
2	VBI91102	Impeller	1
3	VBB91101	Base	1
4	VBE91101	Cover, Impeller	1
5	NUT90213	Locknut, Shaft	1
6	WSH90174	Lockwasher, Shaft	1
7	WSH90179	Shim, Shaft to Impeller (as required)	1
8	MOT90200	Motor, 254-6TC, 15 HP, 3PH, 50/60Hz	1
8A	MOT90236	Motor, 254-6TC, 15 HP, 3PH, 575 Volt, 50/60Hz	1
8B	MOT90219	Motor, 254TC, 15 HP, 3PH, XP, 50/60Hz	1
8C	MOT90483	Motor, 254TC, 15 HP, 3PH, 60Hz	1
9	SCR90882	M10 x 1.5 Hex Head Bolt x 1.57 [40] Long	4
10	WSH90137	Lockwasher, M10	4
11	WSH90183	Flat Washer M10	4
12	SCR90881	M8 x 1.25 Hex Head Bolt x 1.18 [30] Long	2
13	WSH90182	Flat Washer M8	2
14	SCR90876	M6 x 1.0 Hex Head Screw x .98 [25] Long	8
15	WSH90143	Lockwasher, M6	8
16	WSH90142	Flat Washer M6	8
17	SCR90335	1/2-13 x 1.0 Long Socket Cap Screw	4
18	GSK90160	Gasket, Case	1
19	GSK90159	Gasket, Flange	2
20	FLC90011	Flange, 3 FNPT	2
21	SCR90883	M8 x 1.25 Hex Head Bolt x 2.16 [55] Long	4
23	PLG90037	Plug, 1/4 NPT x .43 [11] Long	1
25	INS90024	Absorber	4
26	SCN90061	Absorber Screen	2
27	KEY90082	Key	1
28	SEL90106	Lip Seal	1
29	SPR90089	Spacer, Washer (Case to Base)	2
30	N/A	Impeller to case gap specification	N/A
31	PLC90030	Case Plate	1

VB110

Performance Curves





VI. Troubleshooting Guide

Trouble	Possible Cause	Corrective Action
Blower Does Not Turn and there is -		
A Humming Sound	– One phase of power line disconnected	Connect power leads properly
	– One phase of stator line open	Contact factory
	– Bearing(s) defective	Change defective bearing(s)
	– Impeller jammed by foreign material	Clean impeller
	– Impeller jammed against casing or side cover	Adjust gap
	– Rubbing of rotor core and stator core	Contact factory
	– Capacitor open (single-phase models)	Change capacitor
No Sound	– Two phases of power line disconnected	Connect power leads properly
	– Two phases of stator winding open	Contact factory
	– Faulty switch connection	Change switch
	– Fuse blown	Change fuse
Blower Turns, but -		
Fuse Blows	– Fuse capacity insufficient, wiring fault	Inspect wiring
	– Short circuit	Repair
	– Terminals shorted	Improve insulation and check connections
	– Excessive load	Increase air flow
Overheats or Thermal Protector Activates	– Power source unbalance; possible voltage drop	Check voltage; phases must be balanced within 5% and voltage must be within 10% of rated
	– Operating in single-phase condition	Check connections
	– Excessive friction due to defective bearings	Replace bearings
	– Impeller contaminated by foreign material	Clean impeller
	– Impeller rubbing against casing or side cover	Adjust gap
	– Operation at less than minimum rated flow	Increase air flow
	– Inlet air filter clogged	Clear or replace element
Makes Abnormal or Excessive Sound	– Impeller rubbing against casing or side cover	Adjust gap
	– Impeller rubbed by foreign material	Clean impeller
	– Bearing(s) defective	Replace bearings
	– There is a leak or air passages are clogged	Repair or clean
	– Loose cap screw	Tighten screw
	– Air channel noise absorber foam damaged	Replace absorbers

Customer Maintenance Log

DATE	PROCEDURE	COMMENTS	INITIALS

Spencer Corporate Headquarters and Manufacturing Plant, Windsor, CT USA

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